DETREX CORPORATION

ATMOSPHERIC STORAGE TANK CERTIFICATION

Project No. 89215

January 22, 1990

Randers Engineering
INCORPORATED
ENGINEERS • ARCHITECTS • CONSULTANTS • PROJECT MANAGERS

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INTRODUCTION

Detrex Corporation presently utilizes three tanks for the storage of hazardous waste at their Eaton Avenue Plant. Based on the State of Michigan's requirements for certification of hazardous waste storage, Mr. Ronald Swan of Detrex Corporation requested Randers Engineering to assess and certify the hazardous waste atmospheric storage tanks.

The assessment of the tanks, involves one horizontal tank (5000 gallons) and two vertical tanks (2300 and 4500 gallons), and requires determination that the tank system is adequately designed, has sufficient structural strength, and is compatible with the raw materials stored. For approximate location within the plant, see Figure 1 - Site Plan.

During our field investigation work, Mr. Swan requested a quick visual inspection of a 1400 gallon horizontal tank used to store water that is drawn off the three tanks previously mentioned. He indicated the tank was approximately 25 years old.

SCOPE

Based on conversations with Detrex, Randers Engineerings assessment and certification of the tanks will be based on the following:

1. Information on each tank, provided by Detrex personnel, including design and construction basis, materials to be stored, age, and current and past service requirements.

2. Visual inspection of tank interior to determine integrity of storage tank system and checking of wall thicknesses with an ultrasonic pulse/echo transducer.

3. Calculation of vessel wall thicknesses for materials being stored based on vessel geometry and available shop drawings.

4. Brief report summarizing the findings of the assessment for the storage tank systems.

5. Upon satisfactory review of the tank assessment, certification by a registered professional engineer.

ATTACHMENT A-2

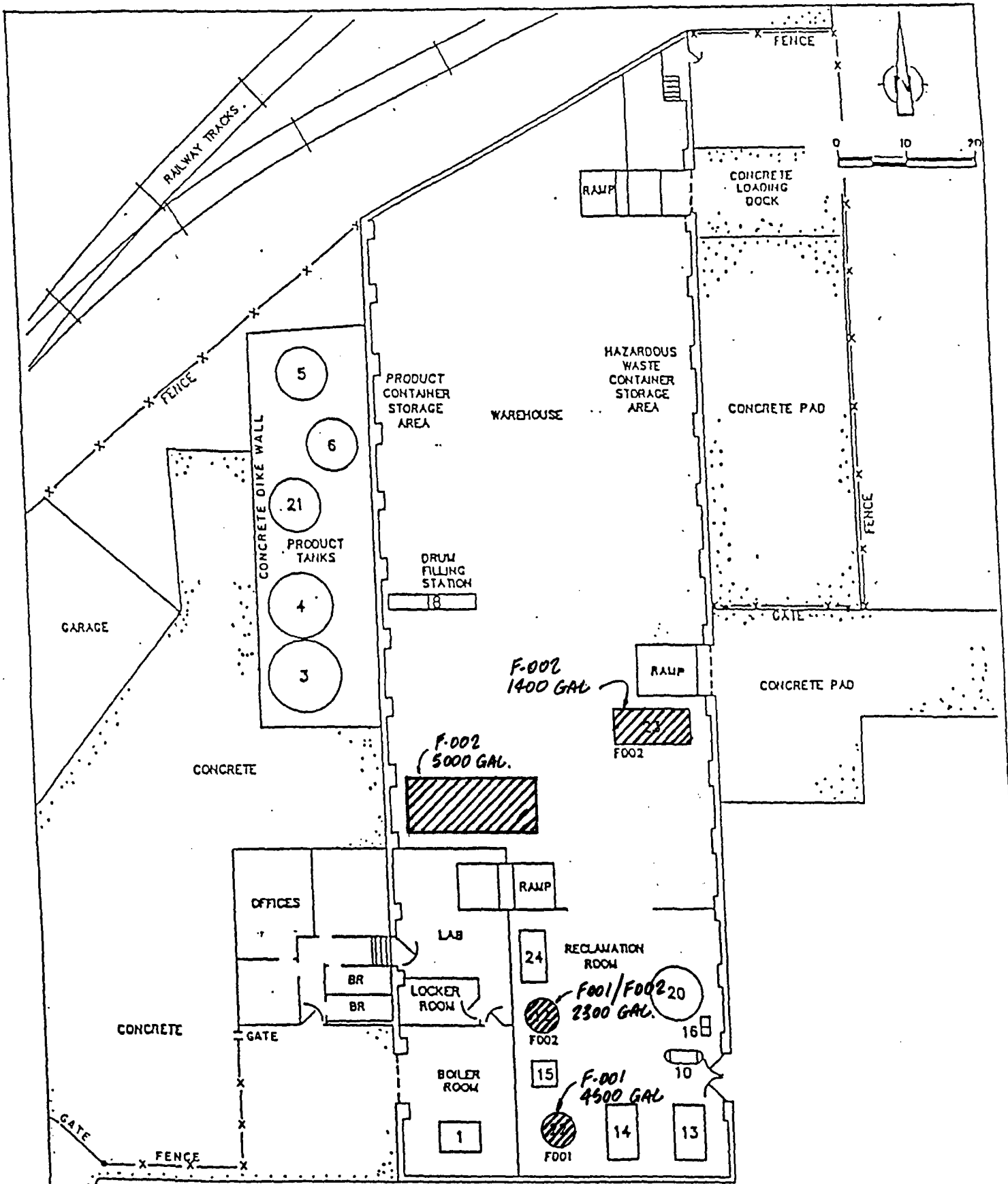


FIGURE 1 - SITE PLAN

FACILITY PLAN
Detrex Corporation
Gold Shield Solvents, Detroit

CRA

2471-28/07/88-1-D-1

CONCLUSIONS

The field investigation/measurements of the tanks and review of the shop drawings has uncovered some potentially serious support problems with each tank. As shown in Appendix "C", calculations, the support structure for each tank is inadequate for storage of the proposed material. The following is a brief description of the problem for each tank:

A. F-001 and F-001/F-002 (Vertical Tanks)

The tank base support, shown on tank shop drawings (Appendix "D"), does not provide adequate support for the tanks base plate. Due to support configuration, when tank is loaded with material, over-stress occurs in the tank base plate. The over-stress exceeds the materials allowable stress by approximately a factor of 2 to 8 times depending on the distance from the main support frame. Tank industry standards typically require uniform support below the base plate or a much heavier base plate design.

B. F-002 (Horizontal Tank)

The saddle spacing and angle of contact for the horizontal tank does not meet tank industry standards. Based on our calculations, the tank shell will be over-stressed at the present saddle location by a factor of 8 times the materials allowable stress. Industry standards recommend location of the saddles at a minimum D/4 from face of head and minimum 120 degree angle of contact.

Also shown in the calculations is a check of shell and head thicknesses based on a maximum stored material specific gravity of 1.60 and corrosion allowance of 1/16 inch. Except for the support problem discussed above, the shell and head thicknesses are adequate for the materials being stored.

Appendix "B", Chemical Resistance Charts, shows the compatibility of the chlorinated hydrocarbon (perchloroethylene, trichloroethylene and trichloroethane) being stored and the tank material (carbon steel). The existence of water with these hydrocarbon will significantly accelerate corrosion of the tanks. When handling these hydrocarbons with water, regular inspection and measurement of tanks MUST be provided. Because of the materials being stored, Randers Engineering recommends as a minimum an annual inspection and shell thickness check.

Tank F-002 (1400 Gallon Tank) used for the storage of water from the other three tanks was reviewed. Access to the tank was not possible because the tank did not have a manhole. Because of the tanks use, its age (25 years old) and the fact that it could not internally be inspected, Randers Engineering does not recommend certification.

RECOMMENDATIONS

Based on the problems previously discussed, the following modifications are required for certification of the three atmospheric storage tanks:

A. F-001 and F-001/F-002 (Vertical Tanks)

Provide rigid support under entire tank base. Recommend filling void in support framing with self leveling concrete and forming and pouring concrete base around framing to support the entire tank base.

B. F-002 (Horizontal Tank)

Recommend one of the following modifications:

1. Relocate tank saddle supports from present location to 20 inches from each end. Increase angle of contact from 90 to 120 degrees.

2. Keep saddles at existing location and weld new stiffening ring around tank at saddle locations.

Before tanks can be certified, all modifications MUST be checked in the field.

STORED MATERIALS

The following is a list of materials, supplied by Detrex, to be stored in the tanks being evaluated.

1. Perchloroethylene (PPG)
2. Trichloroethylene (Detrex)
3. 1,1,1 - trichloroethane (Detrex)
4. Freon TMC Solvent Azeotrope (DuPont)
5. Freon TF and Methanol (DuPont)
6. Freon TFS Cleaning Agent (DuPont)

Notes:

1. Specific gravity of materials listed above range between 1.32 @ 20°C (trichloroethane) and 1.60 @ 20°C (perchloroethylene).
2. Of the chemicals being stored, perchloroethylene is the most corrosive in use with carbon steel. See chemical resistance charts. Appendix "B".
3. Perchloroethylene, trichloroethylene and trichloroethane are chlorinated hydrocarbons. The existence of water with these materials will accelerate corrosion of the tanks. Regular inspections MUST be provided on each tank.

VISUAL FIELD INSPECTION

Based on a visual inspection of each tank, the following is a summary of observations and/or comments.

F-001 - 4500 Gallon Tank

1. Tank Specifics:

   Size: 8'-0" Dia. x 10'-10 3/4" H
   Capacity: 4500 Gallons
   Type: Vertical
   Material: Carbon Steel (Shell and Heads)
   Design Material Thickness: Shell & Heads - 1/4"
   Finish: White epoxy paint outside; no finish inside
   Age: Approx. 6 years

2. Paint thickness on tank measured to be 0.008 to 0.010"

3. All exterior welds look very good. Note; paint covers all welds.

4. All interior welds look acceptable. Minor pitting in areas.

5. Bottom of tank and shell to approximately 4'-0" above bottom looks very good.

6. Shell above 4'-0" has scale and light to moderate pitting. Two deepest pits found in shell are approximately 1/4" diameter. Shell thickness measured at pits was 0.196" and 0.201" respectively. Some larger areas of pitting found but not as deep as areas measured.

7. New 2" dip tube added to top nozzle. Supports welded to side of tank. All welds are acceptable.

8. Tank was clean inside with most scale removed.

9. Top of tank has light scale and minor pitting.

F-001/F-002 - 2300 Gallon Tank

1. Tank Specifics:

   Size: 6'-0" Dia. x 12'-10" H
   Capacity: 2300 Gallons
   Type: Vertical
   Material: Carbon Steel (Shell and Heads)
   Design: Material Thickness: Shell and Heads - 1/4"
   Finish: Outside unknown (fiberglass w/ alum. jacket). From top and bottom, outside finish appears to be white epoxy paint. No finish inside.
   Age: Approx. 5 years

2. Assumed paint thickness similar to tank F-001.

3. Exterior welds could not be checked.

4. Interior weld in top shell section from top to 3'-0" down shows moderate pitting. All other welds are acceptable. Minor pitting in areas.

5. Bottom of tank and shell to approximately 4'-0" above bottom looks very good.

6. Shell above 30" has light to moderate pitting. No unusually deep pits were found.

7. New 2" dip tube added to top nozzle. Supports welded to side of tank. All welds are acceptable.

8. Tank was clean inside with most scale removed.

9. Top of tank has light scale and minor pitting.

F-002 - 5000 Gallon Tank

1. Tank Specifics:

   Size: 7'-0" Dia. x 18'-0" long
   Capacity: 5000 Gallons
   Type: Horizontal
   Material: Carbon Steel (Shell and Head)
   Design Material Thickness: Shell - 1/4" and Head 3/16"
   Finish: White epoxy outside, no finish inside
   Age: Approx. 8 years

2. Paint thickness on tank measured to be 0.008" to 0.010".

3. All exterior welds look very good. Note, paint covers all welds.

4. All interior welds look good.

5. Bottom half of tank looks very good. No pitting noticeable.

6. Upper half of tank has minor pitting. Overall tank is in very good condition.

7. Three new nozzles added to ends of tank (one 3" and two 3/4" couplings). Welds are acceptable.

8. Four new nozzles added to manhole cover on top of tank (three 2" and one 3" coupling). Welds are acceptable.

9. Tank was very clean inside.

F-002 - 1400 Gallon Tank

1. Tank Specifics:

   Size: 5'-4" Dia. x 9'-0" H
   Capacity: 1400 Gallons
   Type: Horizontal
   Material: Carbon Steel
   Design Material Thickness: Unknown
   Finish: White epoxy paint outside; inside unknown
   Age: Approx. 25 years

2. No access available to inside of tank. Inspection not possible for inside of tank.

APPENDIX "A"

Allied Inspection Services, Inc.

Report and Tank Thickness Readings

ALLIED INSPECTION SERVICES, INC.

P.O. BOX 268 ST. CLAIR, MICHIGAN 48079

313 – 329-6697

NONDESTRUCTIVE TESTING INSPECTION REPORT

Report Date 1/3/90

Customer RANDERS ENGINEERING

Address 905 WEST EISENHOWER CIRCLE SUITE 102 ANN ARBOR, MI 48103

Job Location DETREX CORP. - DETROIT, MI

Customer's P.O. No. VERBAL Job No.

NO. PARTS/AREAS AVAILABLE FOR TEST SEE BELOW

TOTAL INSPECTED 2 NO. TO BE REPAIRED

TOTAL REJECTED MATERIAL CARBON STEEL

TOTAL CUT OUT WELDING PROCESS N/A

TOTAL REPAIRED RECORDER USED N/A

NDT Technician GRAHAM/ENGLES	Start 12:00 AM (PM)	Job Location AS ABOVE	Mileage 110	Equipment Used: STRESSTEL "T" MK II 0° TRANDUCER EXOCEN COUPLANT
Division/Department VISUAL/UT.	Finish 6:30 AM (PM)	Standard/Code Used ANSI		
Date Work Performed 1/3/90	Total Hr. 6½	Standby on Job NONE	Travel Hr. 3	

Magnetic Particle: [ ] M-Regular [ ] FM-Fluorescent

Penetrant: [ ] DP-Dye [ ] FP-Fluorescent

Ultrasonic [✓]

Part-Weld-Area No.	Description Welder-Name/No or Part Description	Recommendation With in Code	Recommendation Out of Code	Procedure-Disposition
	ULTRASONIC THICKNESS MEASUREMENTS			
	TAKEN ON 3 STORAGE TANKS			
	TANK # F001 - PITTING NOTED -		APPROX 1/4" ϕ - .090" DEEP	
	# F002 - NO THINNING NOTED.			
	# F001/F002 - NO THINNING NOTED.			
NOTE:	READINGS SHOWN IN RANDERS REPORT			
	VISUAL INSPECTION RESULTS.			
F001	- NOTED MODERATE TO LIGHT		PITTING - 3 PITS	
	MEASURED APPROX 1/4 ϕ ∮ .090" DEEP.			
	ALL WELDS LOOK OK			
F002	- LIGHT PITTING NOTED	TOP ⅓ OF VESSEL	- ALL WELDS	
	LOOK OK			
F001/F002	LIGHT TO MODERATE	PITTING NOTED STARTING APPROX		
	3 FEET ABOVE FLOOR - TO TOP -		ALL WELDING OK.	

IP - Inadequate Penetration
NF - Nonfusion
ACC/DIS - Accumulation of Discontinuities
BT - Burn Through
IU - Internal Undercut
OU - Outside Undercut
IS - Internal Shrinkage
P - Porosity
SP - Spherical Porosity
CP - Cluster Porosity
WP - Wormhole Porosity
HB - Linear Porosity
S - Slag
ISI - Isolated Slag Inclusions
ESI - Elongated Slag Inclusions
C - Cracks
SA - Sand
CC - Crater Crack
SC - Star Crack
TC - Transverse Crack
AB - Arc Burn
M - Masking Indication
L - Linear Indication

NDT Technician

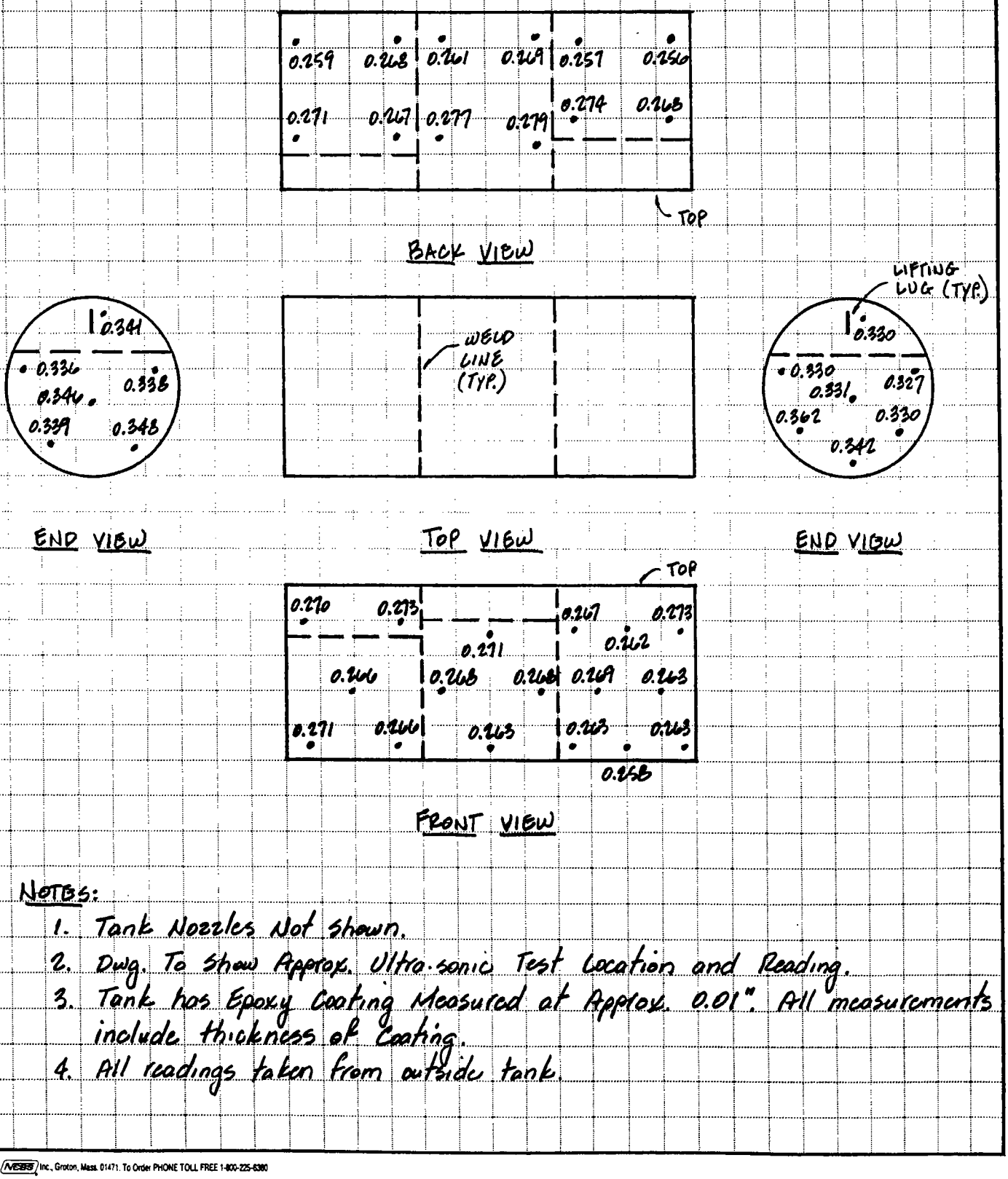
D. Kevin Bingel
Co. Representative

I CERTIFY THAT WORK WAS PERFORMED AS SHOWN ABOVE.

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

JOB DETREX CORP. - Job #89215
SHEET NO. F-002 TANK OF
CALCULATED BY DKB DATE 1-8-90
CHECKED BY DATE
SCALE

F-002 - 5000 Gallon Horiz Tank (7'-0" Dia x 18'-0" L)
UT Readings



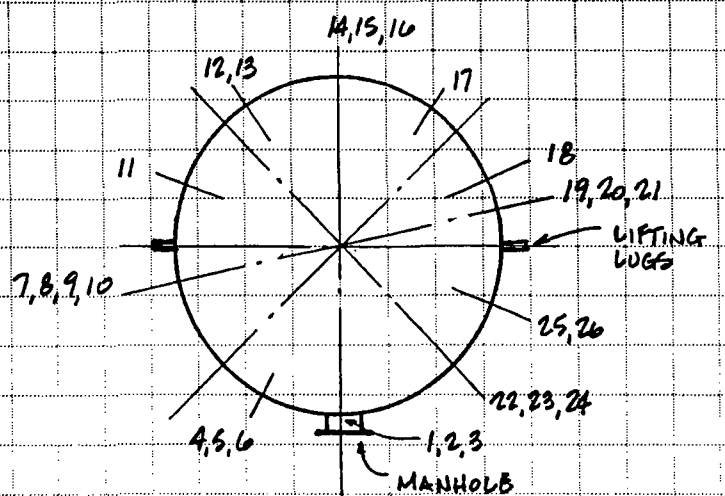
NOTES:

1. Tank Nozzles Not Shown.
2. Dwg. To Show Approx. Ultra-sonic Test Location and Reading.
3. Tank has Epoxy Coating Measured at Approx. 0.01". All measurements include thickness of Coating.
4. All readings taken from outside tank.

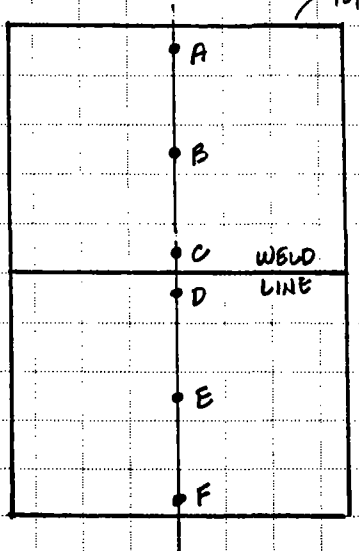
Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

JOB DETREX CORP. - Job # 89215
SHEET NO. F-001 Tank OF
CALCULATED BY DKB DATE 1-8-90
CHECKED BY DATE
SCALE

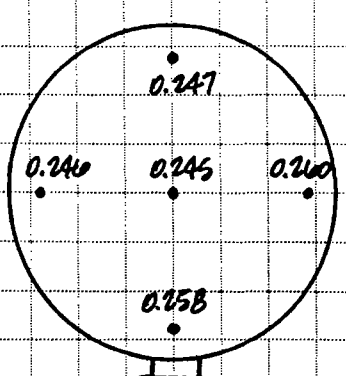
F-001 - 4500 Gallon Vertical Tank (8'-0" Dia x 10'-10¾")



TOP VIEW



FRONT VIEW



BOTTOM VIEW

No.	UT Reading	Location
1	0.275	A
2	0.250	C
3	0.239	E
4	0.240	B
5	0.246	D
6	0.227	F
7	0.261	A
8	0.243	C
9	0.241	D
10	0.235	F
11	0.250	B
12	0.253	A
13	0.238	C
14	0.250	B
15	0.222 *	D
16	0.231	F
17	0.244	E
18	0.226	F
19	0.265	A
20	0.261	C
21	0.238 *	D
22	0.254	B
23	0.261	D
24	0.231	F
25	0.196 *	D
26	0.201 *	D

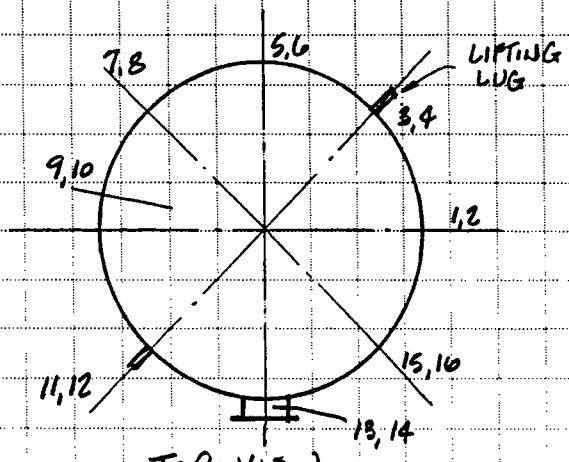
* Reading without Paint

NOTES: Same as Tank F-002 (5000 Gal)

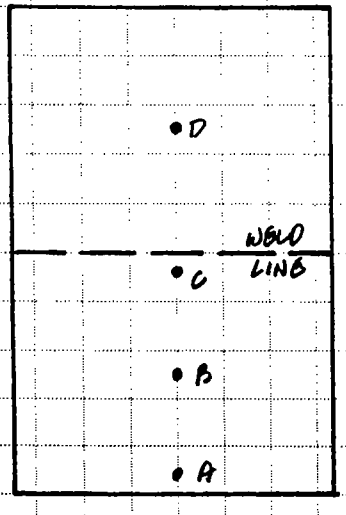
Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

JOB DETROX CORP. Job # 89215
SHEET NO. F-001 / F-002 OF
CALCULATED BY DKB DATE 1-8-90
CHECKED BY DATE
SCALE

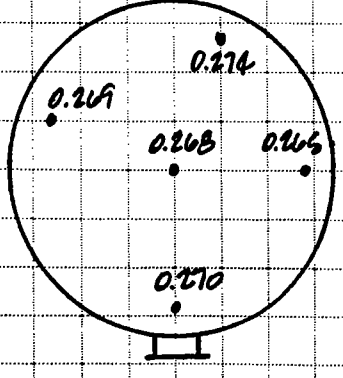
F-001 / F-002 - 2300 Gallon Vertical Tank (6'-0" Dia x 10'-10")



TOP VIEW



FRONT VIEW



BOTTOM VIEW

NO.	UT READING	LOCATION
1	0.250	A
2	0.261	C
3	0.251	B
4	0.254	D
5	0.252	A
6	0.241	C
7	0.254	B
8	0.244	D
9	0.252	A
10	0.266	C
11	0.249	B
12	0.239	D
13	0.260	A
14	0.279	C
15	0.244	B
16	0.240	C

NOTES:

1. Tank nozzles not shown
2. Dwg. to show approx. ultra-sonic test locations and readings.
3. Tank is covered with fiberglass insulation and aluminum jacket. Assume paint thickness = 0.01"
4. All readings taken from inside tank

FROM "DEZURIK RUBBER & METAL SELECTION GUIDE".

Corrosive Media		Metal Type														
		Cast Iron	Ni-Resist	Carbon Steel	304 S.S.	316 S.S.	317 S.S.	Alloy 20	Monel	Nickel	Hastelloy B	Hastelloy C	Bronze	Acid-Bronze	Aluminum
Oxalic Acid	To 10% to 75°F (24°C)				A	A	A								
	To 10% to boiling							A							
	All conc. to boiling							B			B	B			
Oxygen	100% to 150°F (66°C)	A	A	A									A	A	
Paint (Oil or water base)	To 100°F (38°C)	A	A										A		
Palmitic Acid	To 75°F (24°C)	B			A	A	A							B	
Paper Pulp (non-Chlorinated)	To 160°F (71°C)	C	B		A	A	A	A					C	B	
(Chlorinated)	To 110°F (43°C)		B			B	B	A				A			
	To 160°F (71°C)											A			
Parafine (molten)				A	A	A	A								
Pentane	100% to 75°F (24°C)	A	A										A		A
Perchloroethylene	To 150°F (66°C)	B	A		A	A	A						B		
	100% to 400°F (204°C)							A							
Petroleum Ether					A	A	A								
Petroleum Oils	To 150°F (66°C)	A	A	A											
(with H_2S, dilute acids, etc.)	To 150°F (66°C)		B			A	A								
Phenol	To 75°F (24°C)	B	B		A	A	A	A					B		A
	To 10% to 212°F (100°C)							A							
	80%-100% to 125°F (52°C)														A
	95% to 300°F (149°C)							A		A					
	All conc. to boiling									B	B				
Phenolsulfonic Acid	30% to 212°F (100°C)									A					
	100% to 212°F (100°C)									A					
Phosphoric Acid	To 25% to boiling				B	A	A	A							
	To 40% to 200°F (93°C)				B	A	A	A							
	To 50% to boiling									A					
	To 75% to 160°F (71°C)							A							
	All conc. to 125°F (52°C)					A	A	A							
	All conc. to 150°F (66°C)									A					
	All conc. to boiling									B					

Corrosive Media		Metal Type														
		Cast Iron	Ni-Resist	Carbon Steel	304 S.S.	316 S.S.	317 S.S.	Alloy 20	Monel	Nickel	Hastelloy B	Hastelloy C	Bronze	Acid-Bronze	Aluminum
Phosphorus Trichloride						A	A	A							
Phthalic Acid	To 75°F (24°C)			.		B	B	B	A				B		
Phthalic Anhydride	To 300°F (149°C)	A	A	A											
	To 500°F (260°C)							A*			A	A			
Picric Acid	To 150°F (66°C)				A	A	A	A					B		
Pine Oil	To 150°F (66°C)	B			A	A	A						B		B
Plating Solution (brass)	To 140°F (60°C)											A			
Plating Solution (chromium)	To 130°F (54°C)				A	A	A								
Plating Solution (copper)	To 170°F (77°C)										A				
Plating Solution (nickel)	To 140°F (60°C)										A				
Plating Solution (tin)	To 100°F (38°C)										A				
Potassium Acetate	100% to 75°F (24°C)	A		A											
Potassium Bicarbonate	All conc. to 75°F (24°C)	B	A										A		
	To 40% to boiling										B				
Potassium Bichromate	To 75°F (24°C)				A	A	A								
Potassium Bisulfate	To 75°F (24°C)					A	A	A					C		
Potassium Bromide	To 75°F (24°C)				B*	A*	A*				A				
Potassium Carbonate	All conc. to 75°F (24°C)	B	B	B	A	A	A						B	B	
	All conc. to boiling							B		B					
Potassium Chlorate	To 100°F (38°C)	B	B		A	A	A						B		
Potassium Chloride	To 5% to 75°F (24°C)		A			A*	A*		A				C		
	To 5% to boiling										A				
	28% to 175°F (80°C)		A					B	A						
	To 30% to 212°F (100°C)					A*	A*	A*		A					
Potassium Chromate	To 30% to 212°F (100°C)					B	B	B	B		A	A			

*Indicates that pitting corrosion might occur.

*Indicates that pitting corrosion might occur.

A Suggested, based on valve usage experience, data from metal suppliers and data from standard references.

B May be used, however, corrosion resistance is less and the rating is more dependent on the service conditions of the application. Testing is recommended before usage.

C Not used.

FROM "DEZURIK RUBBER & METAL SELECTION GUIDE"

Corrosive Media		Metal Type															
		Cast Iron	Ni-Resist	Carbon Steel	304 S.S.	316 S.S.	317 S.S.	Alloy 20	Monel	Nickel	Hastelloy B	Hastelloy C	Bronze	Acid-Bronze	Aluminum
Sulfuric Acid	To 3% to 150°F (66°C)					A	A								
	To 5% to 200°F (93°C)							A							
	To 8% to 100°F (38°C)					A	A								
	To 10% to 70°F (21°C)	A				A	A								
	To 10% to 175°F (80°C)							A							
	To 20% to 70°F (21°C)					A	A								
Aerated Solutions Only	To 25% to 160°F (71°C)				B	A	A								
Aerated Solutions Only	25% to 90% to 100°F (38°C)				A	A	A								
Aerated Solutions Only	25% to 90% to 125°F (52°C)				B	A	A								
	To 30% to 150°F (66°C)							A							
	To 55% to boiling										A				
	85% to 100% to 70°F (21°C)	A				A	A								
Aerated Solutions Only	90% to 100% to 125°F (52°C)				A	A	A								
	93% to 100% to 100°F (38°C)	A				A	A								
	97% to 100% to 125°F (52°C)					A	A								
	All conc. to 125°F (52°C)							A							
	All conc. to 160°F (71°C)										A				
	Fuming to 70°F (21°C)	B				B	B	A			A	A			
Sulfuric Acid Vapors	To 100°F (38°C)										A				
	To 200°F (93°C)											A			
Sulfurous Acid	To 75°F (24°C)					A*	A*	A							
	All conc. to boiling											B			
Syrup					A	A	A								
Tall Oil	To 500°F (260°C)					A	A								
	To 600°F (316°C)					B	B					A			
Tannic Acid	To 75°F (24°C)	C				A	A	A					B	A	
	To 150°F (66°C)					B	B	A							
	To 212°F (100°C)							B							
Tartaric Acid	50% to 212°F (100°C)				A	A	A								
	All conc. to 100°F (38°C)		B		A	A	A						B	A	B
	All conc. to boiling										B				
Tetrachloroethane	To 150°F (66°C)										A				
Thionyl Chloride	To 125°F (52°C)								A						
	To 10% to 175°F (80°C)										A				
Titanium Sulfate	To 10% to 212°F (100°C)							B							

*Indicates that pitting corrosion might occur.

Corrosive Media		Metal Type															
		Cast Iron	Ni-Resist	Carbon Steel	304 S.S.	316 S.S.	317 S.S.	Alloy 20	Monel	Nickel	Hastelloy B	Hastelloy C	Bronze	Acid-Bronze	Aluminum
Titanium Tetrachloride	To 75°F (24°C)					A	A	A							
	To 10% to boiling										B				
Toluene	100% to 75°F (24°C)	A	A										A	A	
	100% to 212°F (100°C)					A	A	A	A						A
Tomato Juice						B	B								
Trichloroacetic Acid	All conc. to boiling										B	B			
	100% to 212°F (100°C)							B							
Trichloroethane (dry)	100% to 75°F (24°C)			A											
Trichloroethylene	To 75°F (24°C)	B	B	B	B*			A					B	A	A
	100% to 125°F (52°C)														A
	100% to 212°F (100°C)								A						
	100% to boiling									A		A			
Trichloropropane	100% to 75°F (24°C)					A	A	A	A						
Tricresyl Phosphate	100% to 100°F (38°C)			A											
	90% to 700°F (370°C)											A			
Triethanolamine	100% to 75°F (24°C)	A	A	A		A	A								
Trisodium Phosphate	To 20% to 175°F (80°C)	B		B	A	A	A								
Tung Oil	To 100°F (38°C)	B				A	A	A					B		
Turpentine	To 100°F (38°C)	B	A		A	A	A						B	A	
	80% to 100% to 100°F (38°C)														A
	95% to 100% to boiling														A
Urea Ammonia Liquor	To 100°F (38°C)		B		B	A	A								
Uric Acid					A	A	A								
Vanadium Ashes	To 600°F (316°C)					A	A	A							
Vanadium Pentoxide	To 600°F (316°C)					A	A	A							
Varnish					A	A	A								
Vegetable Juices					A	A	A								

*Indicates that pitting corrosion might occur.

A *Suggested, based on valve usage experience, data from metal suppliers and data from standard references.*

B May be used, however, corrosion resistance is less and the rating is more dependent on the service conditions of the application. Testing is recommended before usage.

C *Not used.*

FLUID	NAVAL BRONZE	RATING	ALUMINUM B-356	RATING	CARBON STEEL—DUCTILE IRON	RATING	316 STAINLESS STEEL	RATING
Nitric acid (anhydrous)		D	≤70°F ≤175°F	A C		D	≤70°F ≤120°F	B D
Nitrobenzene	100%; ≤200°F	B	100%; ≤200°F	B	100%; ≤200°F	A	100%; ≤200°F	B
Nitrocellulose	100%; ≤200°F	B	100%; ≤200°F	B	100%; ≤200°F	B	100%; ≤200°F	B
Nitrous oxide	100%; ≤70°F	B		D	100%; ≤70°F	A	100%; ≤70°F	B
Oils (animal)		A		A		A		A
Oil (cottonseed)		–		B		–		A
Oil (diesel)		B		A		B		A
Oil (fish)		C		A		D		A
Oil (fuel)		B		A		A		A
Oil (hydraulic petroleum)		B		–		B		A
Oil (hydraulic synthetic)		B		–		B		A
Oil (lard)		A		A		C		B
Oil (linseed)		B		A		A		A
Oil (lube and grease)		A		A		A		A
Oil (mineral)		A		A		A		A
Oil (pine, gum)		B		A		B		A
Oil (refined petroleum)		B		A		A		A
Oil (sour petroleum)		C		A		B		A
Oil (soybean)		B		B		C		A
Oil (transformer)		B		A		B		A
Oleic acid	10%; ≤70°F 100%; ≤120°F	D C	>90%; ≤200°F	B	100%; ≤120°F	B	<100%; ≤70°F 100%; ≤300°F	B A
Oleum (air free)		D	100%; ≤70°F	B	100%; ≤300°F	B	100%; ≤400°F	B
Oxalic acid	<100%; ≤70°F 100%; ≤70°F	B C	All conc.; ≤70°F All conc.; ≥120°F	B D		D	<100%; ≤70°F All conc.; ≤200°F	B D
Oxygen		A		A		C		B
Ozone		– –	Wet Dry	B A	Wet Dry	C A	Wet Dry	A A
Palmitic acid		–	>90%; ≤70°F 100%; ≤200°F	B D	100%; ≤70°F 100%; ≤400°F	B D	100%; ≤400°F	A
Parafin		A		A		B		A
Perchloroethylene	100%; ≤70°F	B	100%; ≤200°F	B	100%; ≤700°F	B	100%; ≤700°F	B
Phenol	100%; ≤70°F 100%; 70-400°F	A B	>90%; ≤175°F 100%; ≤300°F	A D	(Sulphur free) 100%; ≤200°F 90%; ≤300°F	A B	100%; ≤700°F 90%; ≤300°F	A B
Phosphoric acid (85%) (air free)	>90%; ≤200°F ≤90%; ≥300°F	B D		D		D	70%; ≤200°F	B
Phosphoric acid (aerated)		D		D		D	≥80%; ≤125°F ≤100%; ≤175°F	A B
Phosphoric acid vapors		D		–		D	≤200°F	B
Phosphate esters		A		–		A		–
Phthalic acid	100%; ≤400°F	B	100%; ≤200°F	B	100%; ≤200°F	B	100%; ≤500°F	A
Phthalic anhydride	100%; ≤70°F	B	100%; ≤300°F	A	100%; ≤300°F	A	100%; ≤500°F	A
Picric acid		D		D		D	All conc.; 70°F ≤10%; ≤200°F	B
Potassium chloride	≤10%; ≤70°F	C		D	≤10%; ≤125°F	C	≤100%; ≤75°F	A
Potassium cyanide		D		D	≥100%; ≤70°F	B	≤100%; ≤200°F	B
Potassium hydroxide (10%)		D		D	≤200°F	B	≤200°F	B
Potassium hydroxide (to 70%)		D		D		D	≤200°F	B
Potassium nitrate	All conc.; ≤200°F	B	All conc.; ≤200°F	A	All conc.; ≤200°F	B	All conc.; ≤200°F	B
Potassium phosphate (monobasic)		D		D	≤30%; ≤70°F	B	≤30%; ≤200°F	B

KEY TO RATING SYMBOLS:

- **A** RECOMMENDED
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- **C** PROBABLY UNSUITABLE
- **D** UNSATISFACTORY

KEY TO CONCENTRATION, TEMPERATURE SYMBOLS:

- **<** LESS THAN
- **≤** LESS THAN OR EQUAL TO
- **≥** EQUAL TO OR GREATER THAN
- **>** GREATER THAN

FLUID	NAVAL BRONZE	RATING	ALUMINUM B-356	RATING	CARBON STEEL–DUCTILE IRON	RATING	316 STAINLESS STEEL	RATING
Sulfuric acid (40-75%)		D		D		D		D
Sulfuric acid (75-95%)		D		D	70°F >120°F	B D	70°F >175°F	C D
Sulfuric acid (95-100%)		D		D	70°F >120°F	B D	70°F >120°F	B D
Sulfurous acid	<10%; 70°F	B	<10%; 70°F	B	<10%; 70°F	C	<20%; 70°F	B
Tall oil		D		D	<200°F	B		B
Tallow (molten)		–		B		B		A
Tannic acid	100%; 70°F	C	<40%; 70°F 100%; 70°F	B D	100%; 70°F <10%; 70°F	A D	All conc.; <200°F	B
Tartaric acid	<10%; 70°F 20-40%; 70°F	A C	<50%; 70°F <50%; >120°F	B D		D	<50%; <200°F	A
Tetraethyl lead		D		B		–		B
Toluol and toluene	<200°F	A	<200°F	A	<200°F	A	<200°F	A
Toluene diisocyanate		–		–		–		A
Tributyl phosphate		–		–	100%; 70°F	A		–
Trichloroethylene	Dry; <300°F Wet	B D	100%; <120°F 100%; >175°F	A B	Dry; <300°F Wet	B D	90%; <200°F 100%	A B
Turpentine	<120°F	B	<120°F	B	<120°F	B	<120°F	B
Urea	<60%; 70°F	B	<60%; <200°F	B		D	<50%; <200°F	B
Varnish		A		A		C		A
Vinyl acetate	100%; 70°F	B	100%; 70°F <100%; 70°F	B D	100%; 70°F	A	100%; 70°F	B
Vinyl chloride	<10%; 70°F 100%; 70°F	D A	100%; 70°F	B	Dry; 70°F Wet; 70°F	A D	100% 90%; <70°F	B A
Water, acid mine		–	<120°F	A	70°F	D	70°F	A
Water, fresh (depends on mineral content)		A		B		B		A
Water, deionized		D	<120°F	A	70°F	D	<120°F	A
Water, salt		B		–		C	Depends on velocity	C
Waxes		–		A		–		A
Whiskey and wines		–		B		–		A
Xylene or xylol	<200°F	A	<200°F	A	<200°F	B	<200°F	B
Zinc chloride		D		D		D	<50%; 200°F <10%; 70°F	D A
Zinc sulfate		D	<10%; 70°F	B		D	<30%; <200°F	A

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Corrosion Resistance Chart

G—Good F—Fair D—Depends on Conditions P—Poor

Media	Alum-inum	Alloy 20	Bronze	Carbon Steel	Ductile Iron	304 S.S.	316 S.S.	Hast-elloy B	Hast-elloy C	Monel	7740 Glass	Buna-N	Kynar	Neo-prene	TFE	Viton
Lactic Acid (Conc. Hot)	P	G	P	P	P	F	F	D	D	..	..	P	..	P	G	..
Linoleic Acid	G	G	F	F	F	G	G	..	..	..	..	G	D	F	G	G
Magnesium Bisulfate	F	G	F	F	F	G	G	..	..	..	G	..	G	..	G	..
Magnesium Chloride	P	G	D	P	P	F	F	G	G	G	G	G	G	G	G	G
Magnesium Hydroxide	P	G	D	F	F	G	G	G	G	G	G	G	G	G	G	G
Magnesium Hydroxide (Hot)	P	G	P	F	F	G	G	G	G	G	..	F	D	G	G	G
Magnesium Sulfate Solutions	F	G	G	F	F	G	G	G	G	F	G	G	G	G	G	G
Mercuric Chloride	P	D	P	P	P	P	D	P	G	P	G	..	G	G	G	..
Mercuric Cyanide	P	G	P	P	P	G	G	P	G	P	..	..	G	..	G	..
Mercury	P	G	P	G	F	G	G	G	G	F	G	G	G	G	G	G
Methyl Acetate	G	G	G	F	F	G	G	G	G	..	..	P	..	P	G	P
Methyl Acetone	G	G	G	G	G	G	G	G	G	G	..	P	..	P	G	P
Methyl Alcohol	F	G	G	G	G	G	G	G	G	G	..	G	..	G	G	D
Methylamine	G	G	P	G	F	G	G	..	..	..	..	..	..	G	G	..
Methyl Cellosolve	G	G	G	G	G	G	G	..	..	..	..	G	G	G	G	..
Methyl Chloride (Wet)	P	G	G	G	G	G	G	..	..	..	G	P	G	P	G	..
Methyl Ethyl Ketone	G	G	G	G	G	G	G	G	G	G	G	P	F	P	G	P
Methyl Formate	P	..	G	P	P	F	F	..	..	..	..	P	..	F	G	..
Methylene Chloride	G	G	G	F	F	G	G	G	G	G	G	P	G	P	G	P
Milk	G	G	G	P	P	G	G	..	..	F	G	G	G	G	G	G
Mixed Acids (Cold)	P	G	P	D	D	F	G	..	..	..	G	..	..	..	G	..
Molasses	G	G	F	P	D	G	G	G	G	F	..	G	..	G	G	G
Naptha	G	G	G	G	G	G	G	G	G	G	G	G	G	F	G	G
Napthalene	G	G	G	G	G	G	G	G	G	G	..	P	G	P	G	G
Natural Gas	G	G	G	G	G	G	G	..	..	..	G	F	..	G	G	G
Nickel Ammonium Sulfate	P	..	P	P	P	G	G	..	..	..	..	G	G	..	G	..
Nickel Chloride	P	G	P	P	P	F	G	P	G	F	G	G	G	G	G	G
Nickel Sulfate	P	G	D	P	P	F	G	G	G	F	G	G	G	G	G	G
Nicotinic Acid	G	..	G	F	F	G	G	..	..	..	G	..	D	..	G	..
Nitric Acid 10%	F	G	P	P	P	G	G	P	F	P	G	P	G	F	G	G
Nitric Acid 80%	G	G	P	P	P	D	F	P	P	P	G	P	G	P	G	F
Nitric Acid Anhydrous	F	G	P	D	P	F	G	..	P	P	G	..	D	P	G	..
Nitrobenzene	P	G	D	F	F	G	G	F	F	F	G	P	D	P	G	P
Nitrous Gases	F	F	P	F	F	F	F	..	..	..	G	..	..	..	G	..
Oils, Animal	G	G	G	G	G	G	G	..	..	G	G	G	G	F	G	..
Oils, Cottonseed	F	G	F	F	G	G	G	G	G	G	..	G	..	P	G	G
Oils, Fish	F	G	F	F	F	G	G	G	G	..	G	G	..	F	G	..
Oils, Fuel	G	G	F	G	G	G	G	G	G	G	G	G	G	F	G	G
Oils, Lube	G	G	F	G	G	G	G	G	G	G	G	G	G	F	G	G
Oils, Mineral	G	G	G	G	G	G	G	G	G	G	G	G	G	F	G	G
Oil, Petroleum (Refined)	G	G	F	G	G	G	G	G	G	G	G	G	G	F	G	G
Oil, Petroleum (Sour)	F	G	P	P	P	G	G	G	G	P	G	F	G	F	G	G
Oleic Acid (Hot)	G	G	D	P	P	F	G	G	G	F	G	P	G	P	G	G
Oleum Spirits	D	G	D	P	P	F	G	..	..	F	..	P	..	P	G	P
Oxalic Acid (Cold)	F	G	D	P	P	F	F	G	G	F	G	D	G	P	G	G
Oxygen	G	G	F	F	G	G	G	..	..	G	..	G	G	G	G	G
Ozone (Wet)	F	..	F	P	P	G	G	..	..	..	G	..	G	..	G	..
Ozone (Dry)	G	G	G	G	G	G	G	..	..	..	G	..	..	..	G	..
Paints and Solvents	G	G	G	G	G	G	G	..	..	G	G	D	..	D	G	..
Palmitic Acid	F	G	F	P	P	G	G	..	..	F	G	F	G	F	G	G
Perchlorethylene (Dry)	G	G	F	F	F	G	G	..	..	G	..	D	G	D	G	G
Phenol	G	G	F	P	P	G	G	G	G	G	G	D	G	D	G	F
Phosphoric Acid 85% (Hot)	D	F	D	D	D	P	P	F	P	P	D	D	G	F	G	..
Phosphoric Acid 85% (Cold)	D	..	D	P	P	P	F	G	G	..	D	F	G	F	G	..
Phosphoric Acid 50% (Hot)	P	..	P	P	P	F	F	..	P	F	D	F	G	F	G	G
Phosphoric Acid 50% (Cold)	D	..	D	D	D	F	G	..	G	F	P	G	F	G	G	G
Phosphoric Acid 10% (Hot)	D	G	D	D	D	F	G	..	F	D	P	F	..	G	G	G
Phosphoric Acid 10% (Cold)	D	G	D	D	D	F	G	G	G	F	P	F	..	G	G	G
Picric Acid Solutions (Cold)	F	G	P	P	P	G	G	G	G	P	..	F	G	G	G	..
Potassium Chloride Solutions	P	G	F	P	F	P	P	G	F	F	G	G	G	G	G	G
Potassium Cyanide Solutions	D	G	D	F	F	F	F	..	..	G	G	G	G	G	G	G
Potassium Hydroxide (Dilute Hot)	D	G	D	P	F	F	G	..	F	G	..	..	G	G	G	..
Potassium Hydroxide (Dilute Cold)	D	G	D	D	F	F	G	..	F	G	..	..	G	G	G	..
Potassium Hydroxide (to 70% Hot)	D	G	D	D	F	F	G	..	..	G	..	..	G	G	G	..
Potassium Hydroxide (to 70% Cold)	D	G	D	..	G	G	G	..	..	G	..	G	G	G	G	..
Potassium Nitrate	G	..	F	..	G	G	G	..	..	..	G	G	G	..	G	..
Potassium Phosphate (Monobasic)	D	..	..	..	..	..	F	..	..	..	..	..	G	..	G	..
Potassium Phosphate (Dibasic)	D	..	..	..	..	..	F	..	..	..	..	..	G	..	G	..
Potassium Phosphate (Tribasic)	D	..	..	..	..	..	F	..	..	..	..	..	G	..	G	..
Potassium Sulfate	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	..
Potassium Sulfide	D	G	D	F	G	G	G	..	..	F	P	G	G	..	G	..
Potassium Sulfite	G	G	F	F	..	G	G	..	..	G	..	..	G	..	G	..
Propane	G	G	G	F	G	G	G	G	G	G	..	F	G	G	G	G

Note: The information given in this table has been tabulated from various references, for use as a general guide. Before specific applications are made all service conditions, such as pressures, temperatures, concentrations, operating cycles, etc., should be reviewed with the manufacturer or fabricator.

Corrosion Resistance Chart

G—Good F—Fair D—Depends on Conditions P—Poor

Media	Alum-inum	Alloy 20	Bronze	Carbon Steel	Ductile Iron	304 S.S.	316 S.S.	Hast-elloy B	Hast-elloy C	Monel	7740 Glass	Buna-N	Kynar	Neo-prene	TFE	Viton
Propyl Alcohol	G	G	G	G	G	G	G	G	G	G	..	F	G	..	G	..
Resins and Rosins	G	G	F	P	P	G	G	G	G	G	..	P	..	..	G	..
Sea Water	P	G	G	..	P	F	F	G	G	G	..	G	G	G	G	G
Shellac (Bleached)	G	G	G	G	G	G	G	G	G	G	..	G	G	G	G	G
Shellac (Orange)	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Soap Solutions (Stearates)	P	G	G	G	G	G	G	G	G	G	G	G	..	G	G	..
Sodium Acetate	F	G	G	F	F	G	G	G	F	F	..	G	G	..	G	..
Sodium Aluminate	..	G	..	G	G	G	G	..	F	F	..	G	G	..	G	..
Sodium Bisulfate (Cold)	D	G	P	P	P	F	F	G	G	F	G	G	G	G	G	G
Sodium Bisulfite (Cold)	D	G	P	P	P	G	G	F	F	F	G	G	..	G	G	G
Sodium Carbonate Solution	P	G	F	F	F	G	G	G	G	G	P	G	G	G	G	G
Sodium Chlorate	P	F	F	P	P	F	F	P	G	..	G	G	G	G	G	G
Sodium Chloride	P	G	F	F	F	F	F	G	G	G	P	G	G	G	G	G
Sodium Cyanide	D	G	D	F	F	G	G	..	..	G	P	G	G	G	G	G
Sodium Hydroxide 20% (Cold)	D	G	G	G	G	G	G	G	G	G	P	G	G	G	G	F
Sodium Hydroxide 20% (Hot)	D	G	F	F	F	G	G	G	G	F	P	F	G	F	G	P
Sodium Hydroxide 50% (Cold)	D	G	F	F	F	G	G	..	F	G	P	G	F	G	G	P
Sodium Hydroxide 50% (Hot)	D	G	F	F	F	F	F	..	F	G	P	F	G	F	G	P
Sodium Hydroxide 70% (Cold)	D	G	G	F	F	F	F	..	F	G	P	..	..	..	G	P
Sodium Hydroxide 70% (Hot)	D	F	G	F	F	F	F	F	F	F	P	..	..	..	G	P
Sodium Hypochlorite	D	P	D	D	D	P	F	P	F	D	G	..	G	..	G	..
Sodium Metaphosphate	G	G	P	F	F	G	G	..	..	..	..	G	..	G	G	..
Sodium Metasilicate (Cold)	F	..	F	P	P	G	G	..	..	..	..	..	..	G	G	..
Sodium Metasilicate (Hot)	F	..	F	D	D	G	G	..	..	..	..	..	..	..	G	..
Sodium Nitrate	G	G	F	F	F	F	G	P	F	F	G	F	G	G	G	G
Sodium Perborate	F	G	F	F	F	G	G	..	..	F	G	F	..	G	G	G
Sodium Peroxide	F	G	D	P	P	G	G	P	G	F	G	F	G	G	G	G
Sodium Phosphate (Monobasic)	D	G	F	..	..	G	G	G	G	G	F	G	G	..	G	..
Sodium Phosphate (Dibasic)	D	G	G	..	..	G	G	G	G	G	F	G	G	..	G	..
Sodium Phosphate (Tribasic)	D	G	F	..	..	G	G	G	G	G	G	F	G	..	G	..
Sodium Silicate	P	G	F	G	G	F	F	G	G	G	P	G	G	G	G	G
Sodium Silicate (Hot)	P	..	P	P	P	F	F	G	G	G	P	..	G	..	G	..
Sodium Sulfate	P	G	F	F	F	F	F	G	G	G	G	G	G	G	G	G
Sodium Sulfide	D	G	D	F	F	F	F	G	G	F	P	G	G	G	G	G
Sodium Sulfide (Hot)	D	G	D	F	F	F	F	G	..	F	P	..	G	..	G	..
Sodium Sulfite	G	G	..	G	G	F	F	D	F	F	G	..	G	..	G	..
Sodium Sulfite (Hot)	G	G	P	P	P	F	F	..	..	F	G	..	G	..	G	..
Sodium Thiosulfate	F	G	P	P	P	F	G	..	..	F	G	..	G	G	G	G
Steam 212°F.	G	G	P	P	P	G	G	G	G	P	G	G	G	G	G	G
Steam 600°F.	G	G	G	G	F	G	G	..	P	P	..	P	..	P	G	..
Stearic Acid	P	G	F	F	F	G	G	..	..	G	..	..	G	..	G	G
Styrene	D	..	D	F	F	G	G	..	..	G	..	..	G	..	D	..
Sulphur	G	G	D	P	P	F	G	G	G	P	..	D	G	..	G	..
Sulfur Dioxide (Dry)	G	G	G	F	F	G	G	P	G	F	G	D	G	P	G	G
Sulfur Trioxide (Dry)	G	G	G	P	F	G	G	..	..	F	G	D	F	D	G	..
Sulphuric Acid 0-7%	F	G	P	D	D	D	D	G	F	F	G	F	G	D	G	G
Sulphuric Acid 7-40%	D	G	D	D	D	D	D	G	F	F	G	F	G	D	G	G
Sulphuric Acid 40-75%	D	F	P	D	D	D	D	G	F	F	F	P	G	F	G	G
Sulphuric Acid 75-95%	P	G	D	F	F	P	F	G	F	D	F	D	G	D	G	G
Sulphuric Acid 95-100%	D	G	P	F	F	P	F	..	P	D	F	D	G	D	G	F
Sulphurous Acid	P	G	F	D	D	F	F	P	G	D	F	P	G	P	G	G
Tall Oil	F	G	G	G	G	G	G	..	..	F	G	..	G	..	G	G
Tannic Acid (Cold)	F	G	F	P	P	G	G	G	G	F	G	G	G	F	G	G
Tar and Tar Oil	G	G	F	G	G	G	G	G	G	F	G	F	..	P	G	G
Tartaric Acid	F	G	F	G	G	G	G	G	G	F	G	F	G	P	G	G
Toluol and Toluene	G	G	G	G	G	G	G	G	G	G	G	F	G	G	G	G
Tomato Juice	F	G	P	P	P	F	G	G	G	P	G	G	..	G	G	G
Tributyl Phosphate	G	G	G	G	G	G	G	..	..	G	P	..	F	P	G	..
Trichlorethylene (Dry)	G	G	F	G	F	G	G	..	G	G	G	D	G	D	G	F
Tung Oil	F	G	F	F	F	G	G	G	G	F	..	G	..	F	G	G
Turpentine	G	G	F	F	F	G	G	G	G	F	..	F	G	D	G	G
Varnish and Solvents	G	..	G	F	P	G	G	G	G	F	..	P	..	D	G	D
Vinegar	F	G	F	D	D	G	G	G	G	F	G	P	..	D	G	D
Water, Acid Mine	P	G	D	D	D	G	G	G	G	P	..	G	G	G	G	G
Water, Fresh	G	G	D	D	D	G	G	G	G	G	F	G	G	G	G	G
Water, Distilled	G	G	D	D	D	G	G	G	G	G	F	G	G	G	G	G
Water, Salt	F	G	F	D	D	F	F	G	G	F	G	G	G	..	G	G
Waxes	G	G	G	G	G	G	G	..	..	G	..	G	G	F	G	G
Whiskey and Wines	D	G	P	D	F	G	G	..	..	F	G	F	..	G	G	G
Xylene or Xylol	G	G	P	F	F	G	G	G	G	F	G	D	G	G	G	F
Zinc Chloride	D	G	P	D	P	P	F	G	G	F	G	F	G	G	G	G
Zinc Sulfate	D	G	G	D	D	G	G	G	G	F	G	G	G	G	G	G

Note: The information given in this table has been tabulated from various references, for use as a general guide. Before specific applications are made all service conditions, such as pressures, temperatures, concentrations, operating cycles, etc., should be reviewed with the manufacturer or fabricator.

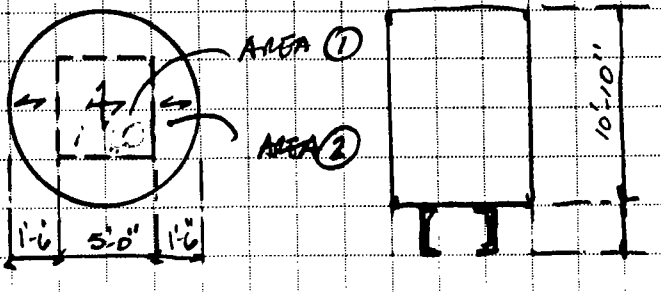
APPENDIX "C"

Calculations

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

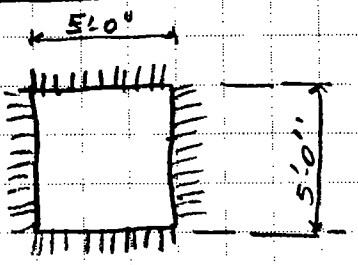
JOB TANK CERTIFICATION
SHEET NO. ____ OF ____
CALCULATED BY M. Mikolajczyk DATE 1-18-90
CHECKED BY ____ DATE ____
SCALE ____

* DESIGN ANALYSIS: 5'-0" ϕ TANK x 10'-10 3/4"



slab weight: #/ft = 11 x 458 x 0.25/12 = 0.11 k/ft.
liquid = 1.6 x 62.4 = 99.84 #/C.F.
∴ Max weight on bottom = 99.84 x 11
= 1098 #/S.F.

AREA ①: Assume As 2 WAY SLAB w/ FIXED ENDS.



$w = \frac{1}{2}(1098) = 549$ #/S.F

edge moment: $\frac{wl^2}{12} = \frac{0.549 \times 5^2}{12} = 1.143$ k-ft.

mid span moment: $\frac{0.549 \times 5^2}{8} - 1.143 = 0.57$ k-ft

tpl. 1/4" $I = \frac{1}{12} \times (\frac{1}{4})^3 \times 12 = 0.0156$ $S = \frac{I}{c/2} = \frac{2I}{0.25} = 0.125$ in^3

$f_b = \frac{1.143 \times 12}{0.125} = 137.5$ TOO HIGH ∴ > ALLOWABLE 22KSI NOT GOOD

AREA ②: OVERHANG

TAKE AVERAGE LOAD = $\frac{1098}{2} = 549$ #/S.F.

$M_{max} = \frac{0.549 \times 1.5^2}{2} = 0.617$ k-ft.

$f_b = \frac{0.617 \times 12}{0.125} = 59.3$ TOO HIGH > ALLOWABLE 22 KSI NOT GOOD

SHELL THICKNESS: $t_{req} = \frac{2.6 D (H-1) G}{Sd} + C.A.$

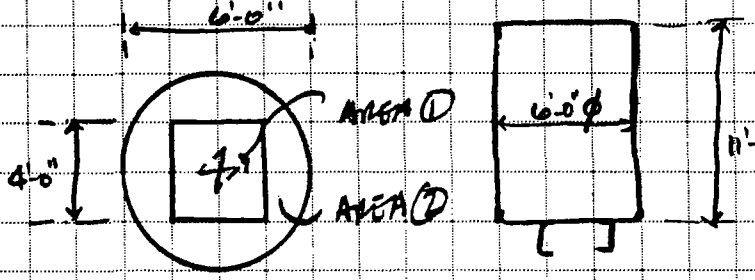
$= \frac{2.6 (8)(11-1)(1.62)}{20{,}000} + 0.0625$

$= 0.079 < 1/4$ ∴ OK

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

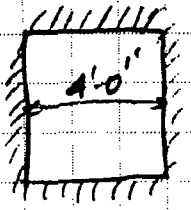
JOB TANK CERTIFICATION
SHEET NO. ____ OF ____
CALCULATED BY M. Ciobelli DATE 1-18-90
CHECKED BY ____ DATE ____
SCALE ____

* DESIGN ANALYSIS: TANK = 11'-0" HIGH x 6'-0" ϕ DIA.



SELF WEIGHT = $11 \times 45 \times \frac{0.25}{12} = 0.11$ K/V.
Liquid = $11 \times 62.4 = 99.84$ #/LF
∴ MAX WEIGHT @ BOTT = 99.84×11
$= 1098$ #/L.F.

AREA ①: ASSUME 2 WAY SLAB ACTION w/ FIXED ENDS



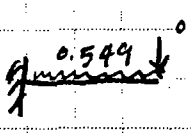
$w = 0.5\,(1098) = 549$ #/S.F.

EDGE MOMENT $= \frac{wl^2}{12} = \frac{0.549 \times 4^2}{12} = 0.732$ K-ft

INTERIOR MOMENT $= -0.732 + \frac{0.549 \times 4^2}{9} = 0.366$

$f_b = \frac{0.732 \times 12}{0.125} = 70.272$ TOO HIGH > 22 KSI ALLOWABLE
∴ N.G.

AREA ②



$M_{max} = 0.549 \times \frac{1^2}{2} + 0.11 \times 1 = 0.385$

$f_b = \frac{0.38 \times 12}{0.125} = 18.45$ ∴ OK < 22 KSI ALLOWABLE

TANK SHELL: $t_{req} = \frac{2.6\,(6)\,(11-1)\,(1.6)}{20 \times 10^3} + 0.0625 = 0.074 < 0.25$ ∴ OK

Randers Engineering
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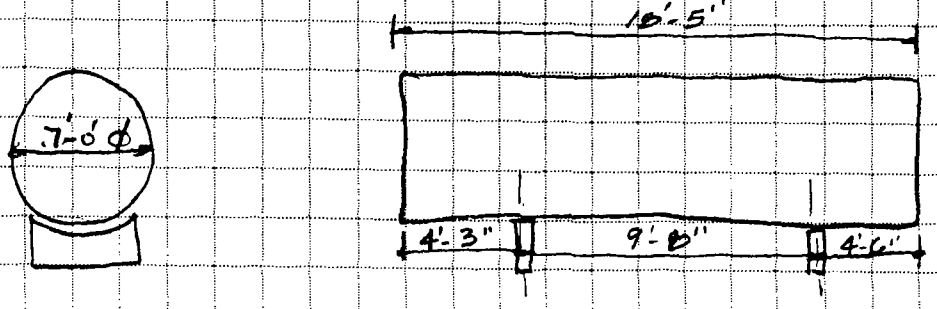
ANN ARBOR, MI 48103
(313) 663-0420

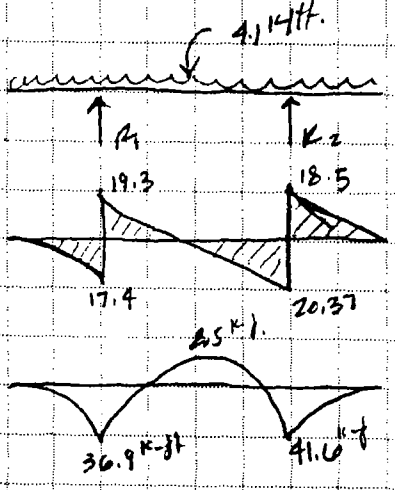
JOB TANK CERTIFICATION
SHEET NO. ____ OF ____
CALCULATED BY M. Kobliss DATE 1-18-96
CHECKED BY ____ DATE ____
SCALE ____

* DESIGN ANALYSIS: HORIZONTAL TANK 7'-0" ϕ X 18'-5" LONG



* LONGITUDINAL BENDING:

WEIGHT OF TANK = 18 × π × 7 × 450 = 40000 #
WEIGHT OF LIQUID = 62.4 × 1.6 × π × 3.5² × 18.4
= 70,814
75,000



∴ W/ft = 75/18.92 = 4.1 K/ft.

$R_1 = \left[\frac{13.91^2}{2}(4.1) - \frac{4.5^2}{2}(4.1)\right]/9.67 = 36.7^K$

$R_2 = 38.3^K$

+VE M = 8.5 K-ft −VE M = 41.6 K-ft

$S = 0.098175 \times \left(\frac{84^2 - 83.5^2}{84}\right) = 1373 in^3$

$\therefore f_b = 41.6 \times 12 / 1373 = 0.362$ KSI ∴ OK.

* TANGENTIAL SHEAR:

$$f_{vt} = \frac{K_2 Q}{R t_s}\left(\frac{L - 2A}{L + 0.75H}\right) = \frac{1.3 \times 38300}{84(0.25)}\left(\frac{221 - 2(54)}{221}\right) = 1.2 \text{ KSI} \therefore \text{OK.}$$

* CIRCUMFERENTIAL STRESS:

AT HORN OF SADDLE:

$$f_{tc} = -\frac{Q}{4t_s(b + 1.56\sqrt{Rt_s})} - \frac{12 K_6 Q R}{L t_s^2}$$

$$= -\frac{38,300}{4(0.25)(4 + 1.56\sqrt{84 \times 0.25})} - \frac{12(0.06)(38,300)(84)}{221(0.25)^2}$$

= 171 KSI TOO HIGH. NOT GOOD.

Randers Engineering
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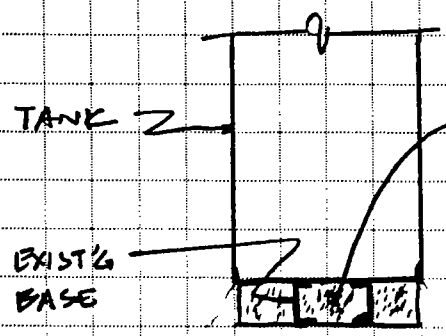
ANN ABRBOR, MI 48103
(313) 663-0420

JOB TANK CERTIFICATION
SHEET NO. _____ OF _____
CALCULATED BY M. Kobeissi DATE 1-18-90
CHECKED BY _____ DATE _____
SCALE _____

* RECOMENDED CORRELTIVE ACTION:

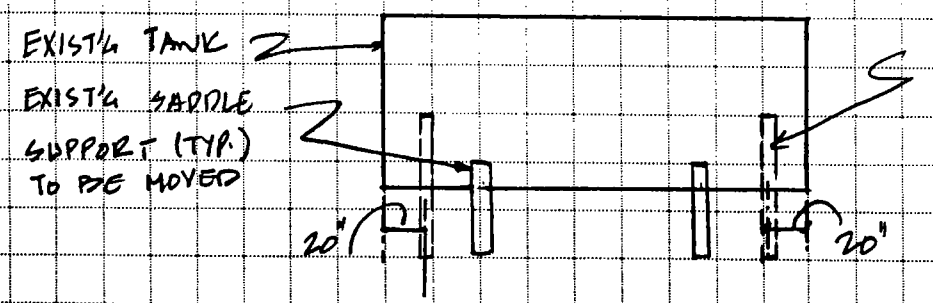
a. VERTICAL TANKS:



FILL TANK BASE WITH SELF LEVELING CONCRETE
RECOMEND THAT SLAB UNDER TANK BE INVESTIGATED FOR BEARING & SUPPORT OF TANK.

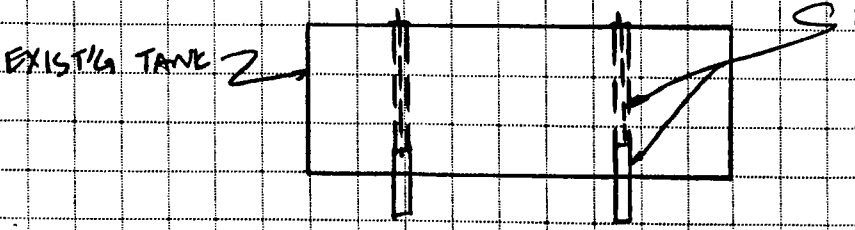
b. HORIZONTAL TANK: 1 OF 2 SOLUTIONS

SOLUTION 1:



MOVE SADDLE SUPPORT TO LOCATIONS SHOWN. INCREASE THE ANGLE OF CONTACT TO 130° (TYP.)

SOLUTION 2:



KEEP SADDLES AT EXIST'G POSITION PROVIDE A NEW STIFFINING RING AROUND THE TANK

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

JOB TANK CERTIFICATION
SHEET NO. ____ OF ____
CALCULATED BY M.Golobissi DATE ____
CHECKED BY ____ DATE ____
SCALE ____

* 1-12-90 2:[30] P.M
TELEPHONE CONVERSATION WITH: STEEL TANK INSTITUTE
708-498-1980.
Mr. Wayne GEYER. (ENGINEERING)

EXPLAINED TO Mr. GEYER THAT TANK IS SUPPORTED ON A CURB. REQUESTED FORMULAS TO ASSIST IN THE CALCULATIONS OF THE STRUCTURAL STRESSES. GEYER EXPLAINED THAT THE METHOD USED TO SUPPORT THE TANK IS NOT PER UL-142 STANDARDS & HE DOES NOT HAVE ANY REFRENCES FOR OUR CASE.

* 1-12-90 2:[30] P.M.
TELEPHONE CONVERSATION WITH: HAMILTON WELDING CO.
614-445-8846
Mr. Michal PINNEY (ENGINEERING)

HAMILTON WELDING CO. IS THE COMPANY THAT FABRICATED THE TANKS. Mr. PINNEY SAID THAT THEY DONT HAVE AN IN-HOUSE ENGINEERING PER-SAY AND THAT MOST OF THE DESIGNS IS BASED ON PAST EXPERIENCE. HOWEVER, He feels That THE BASE OF THE TANK NEEDS TO BE STIFFENED AND THE WAY IT IS CONSTRUCTED DOES NOT MEET INDUSTRY STANDARDS. He CAN NOT PROVIDE US WITH CALCULATIONS OR DESIGN CRITERIA

* 1-12-90 3:[00] P.M.
TELEPHONE CONVERSATION WITH: BUFFALO TANKS ENGINEERING DEPT.
1-800-368-2105
Mr. LARY HANVAN.

EXPLAINED TO MR. HANYAN THE PROCEDURE USED BY US TO ANALYZE THE TANK SUPPORTS. HE AGREED WITH IT. HE ALSO INDICATED THAT THE SUPPORT OF THIS TANK DOES NOT MEET UL-142 OR API-650 WHICH ARE THE STANDARDS USE IN DESIGN OF VERTICAL ATMOSPHERIC PRESSURE. HE RECOMENDS TO REVISE THE SUPPORT DETAIL.

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ABRBOR, MI 48103
(313) 663-0420

JOB TANK CERTIFICATION
SHEET NO. _____ OF _____
CALCULATED BY Milobissi DATE _____
CHECKED BY _____ DATE _____
SCALE _____

* 1-18-90 4:10 P.M.

TELEPHONE CONVERSATION WITH: BUFFALO TANKS ENGINEERING DEPT,
1-800-368-2105
Mr. LARY HANVAN

DISCUSSED ANALYSIS PROCEDURES FOR STRUCTURAL DESIGN OF HORIZONTAL TANKS. MR. HANVAN RAN TANK ANALYSIS ON HIS COMPUTER PROGRAM AND CAME WITH ANSWERS SIMILAR TO OURS. HE ALSO INDICATED THAT THE SADDLE SUPPORTS ARE USUALLY LOCATED AT A MAX DISTANCE OF $\frac{DIAM.}{4}$ FROM TANK HEAD. THE CONTACT ANGLE IS USUALLY A MIN OF 120°. THE TANK IN QUESTION DOES NOT MEET BOTH STANDARD PRACTICE OF TANK DESIGN AND FABRICATION. AS A RESULT THE STRESS AT THE MOMENT EXCEEDS THE ALLOWABLE STRESS AND THUS THE TANK IS UNSAFE FOR USE.

APPENDIX "D"

Existing Tank Shop Drawings

ORIGINAL DRAWINGS—RETURN TO:

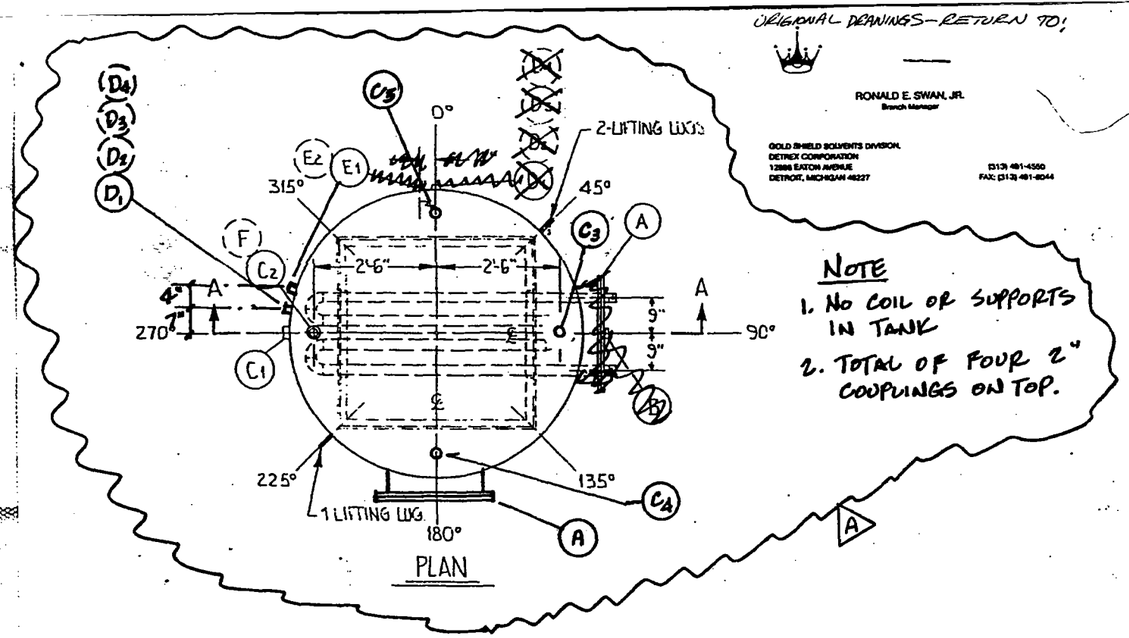
RONALD E. SWAN, JR.
Branch Manager

GOLD SHIELD SOLVENTS DIVISION
DETREX CORPORATION
12998 EATON AVENUE
DETROIT, MICHIGAN 48227

(313) 491-4550
FAX: (313) 491-8044

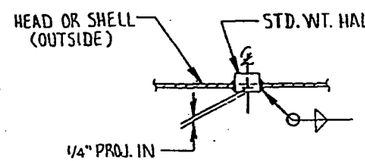
ITEM	RATING	PROJ. IN	QUANT.	REMARKS	NOTE
A	24" STD. U.L. MANHOLE	1/4"	1	SEE SECTION A-A	MANHOLE W/ COIL
B	1 1/2" STD. WT. HALF CPLG.	1/4"	1	SEE SECTION A-A	TEMP. PROBE
C1, C2 & C3	2" STD. WT. HALF CPLG.	1/4"	1 EA.	SEE DETAIL "C"	
D1, D2, D3 & D4	1" STD. WT. HALF CPLG.	1/4"	1 EA.	SEE DETAIL "C"	SIGHT GLASS CONN.
E1 & E2	1" STD. WT. HALF CPLG.	1/4"	1 EA.	SEE DETAIL "C"	SIGHT GLASS CONN.
F	2" STD. WT. HALF CPLG.	0"	1	SEE SECTION A-A	DRAIN W/ PLUG

C3, C4



PLAN

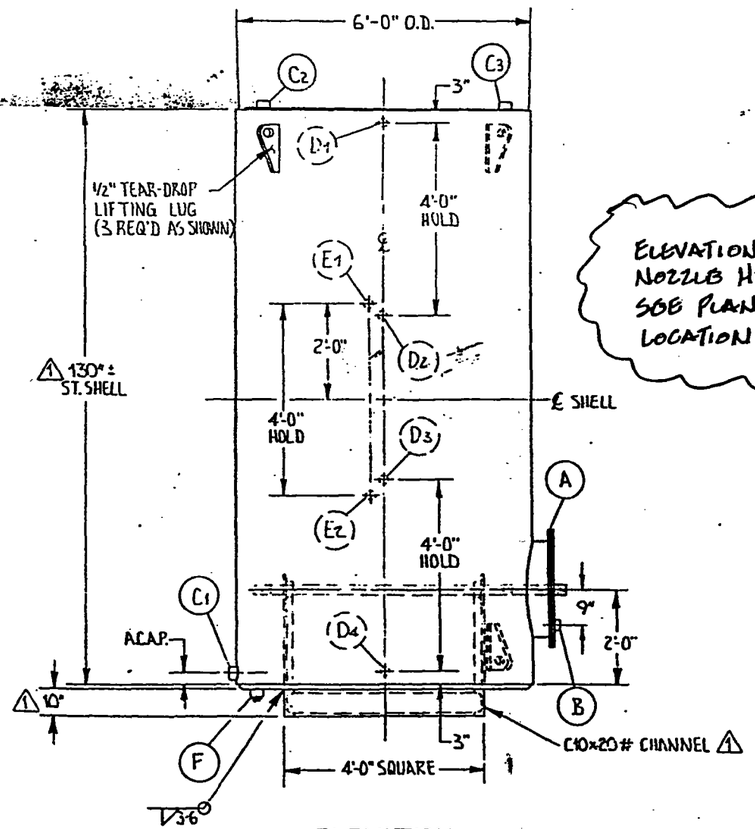
NOTE
1. NO COIL OR SUPPORTS IN TANK
2. TOTAL OF FOUR 2" COUPLINGS ON TOP.



DETAIL "C"

NOTES

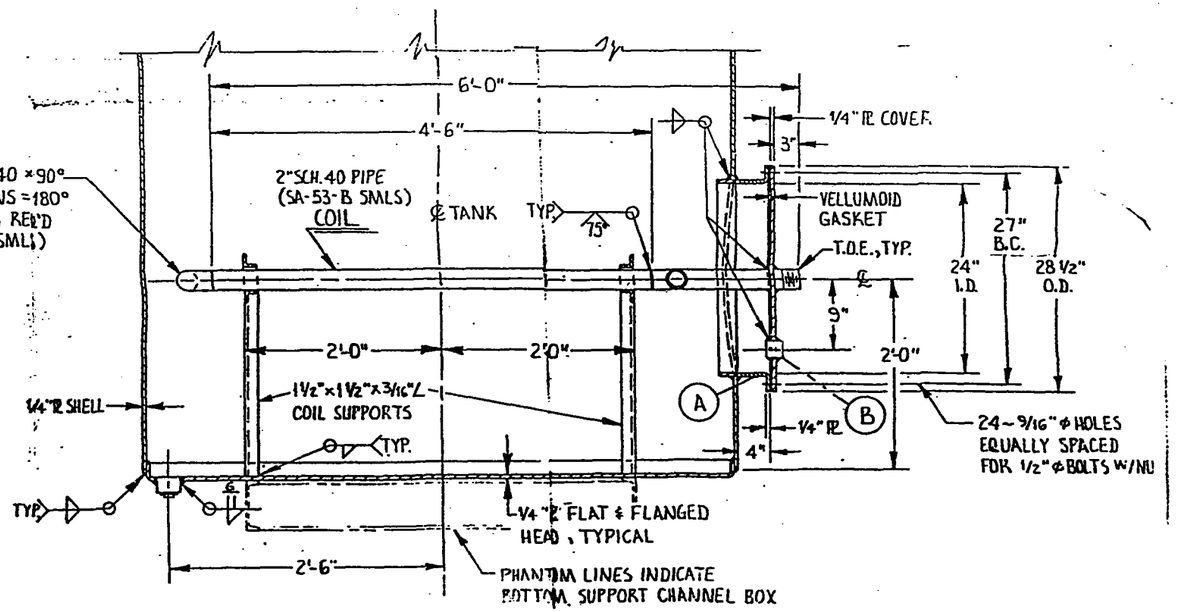
1. MATERIAL : H.R.C.S.
2. TANK DESIGN & OPERATING PRESSURE : ATMOSPHERIC
3. TANK TO BE AIR TESTED W/ A SOAP-SUDS SOLUTION
4. COIL DESIGN & OPERATING PRESSURE : 150 P.S.I.G.
5. COIL HYDROSTATIC TEST PRESSURE: 225 P.S.I.G.
6. ALL OPENINGS TO BE PROTECTED FOR SHIPMENT.
7. INTERIOR : WIRE-BRUSH & VACUUM
8. EXTERIOR : COMMERCIAL SANDBLAST & APPLY ONE SHOP COAT RED OXIDE PRIMER.



ELEVATION

A

ELEVATION FOR NOZZLE HEIGHTS ONLY. SEE PLAN FOR LOCATION



SECTION A-A

APPROVAL FOR CONSTRUCTION
PLEASE SIGN AND RETURN
☐ APPROVED AS SHOWN
☐ APPROVED WITH NOTED CHANGES
CONSTRUCTION WILL BEGIN WHEN SIGNED DRAWING IS RECEIVED

FOR APPROVAL

A REVISIONS MADE PER RANDORS FIELD INSPECTION 1-4-90 (NOT AS BUILT DWG)

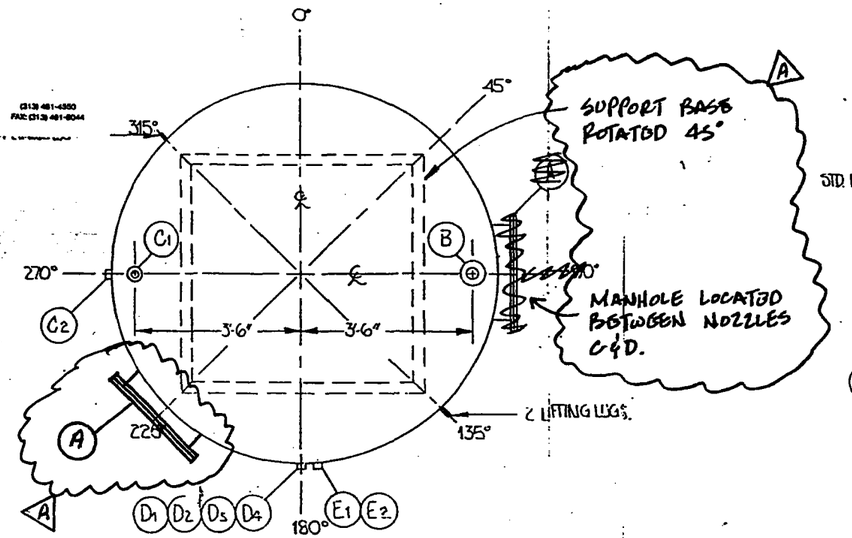
SALES AGENT : FALLER & CO.

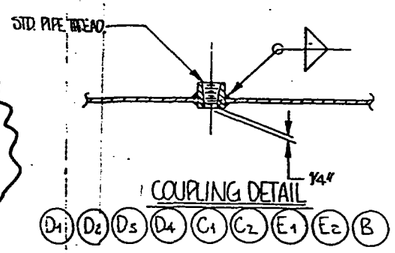
TOLERANCES	REVISIONS			HAMILTON WELDING CO. COLUMBUS HAMILTON
DECIMAL	NO.	DATE	BY	
±	A	2-24-85	MAD.	2300 GAL. VERT. STORAGE TANK

RONALD E. SWAN, JR.
Branch Manager

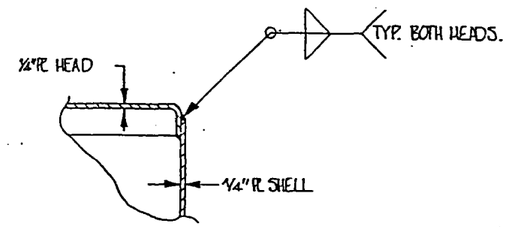
HELD SOLVENTS DIVISION
CORPORATION
STON AVENUE
T, MICHIGAN 48227

(313) 481-4350
FAX: (313) 481-8044





COUPLING DETAIL

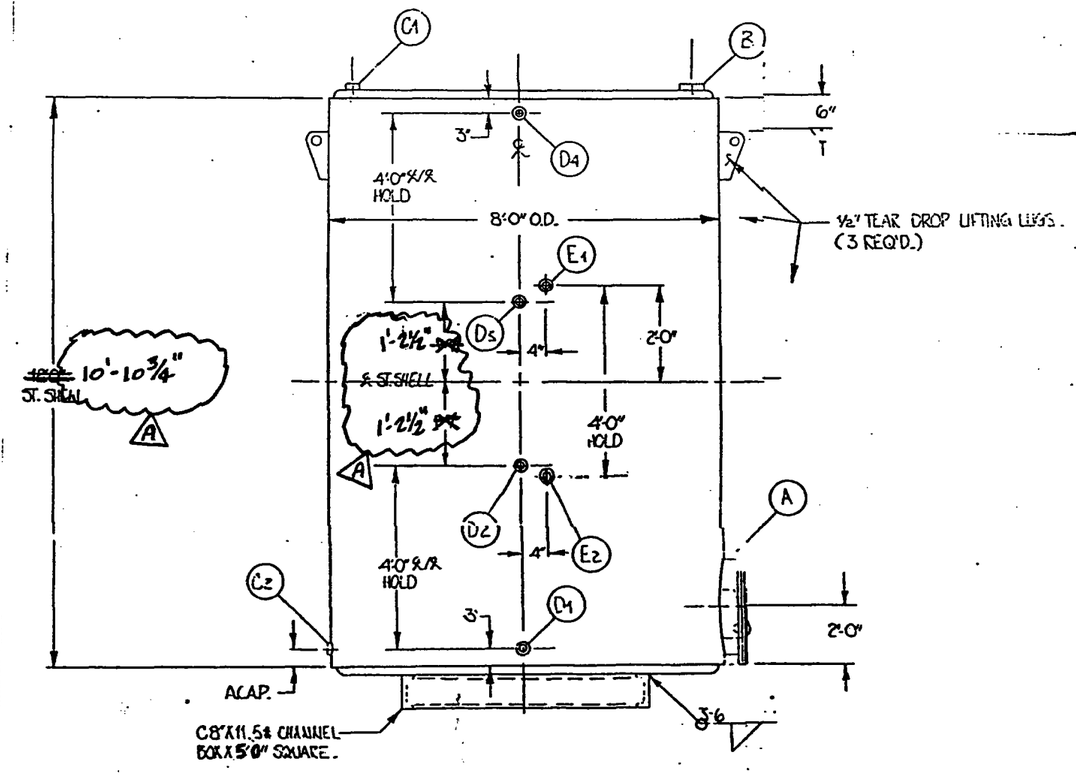


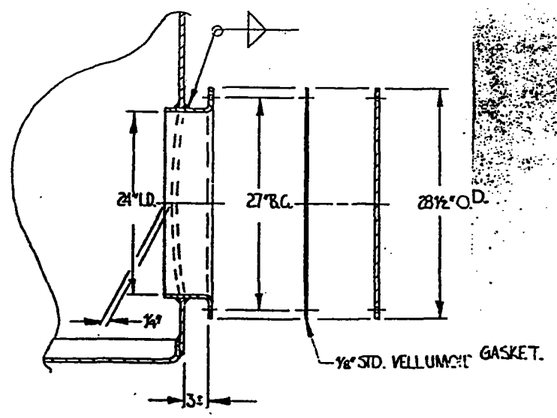
HEAD TO SHELL DETAIL

A	24"	STD	MANWAY	SEE MANWAY DETAIL	
B	4"	—	HALF CPLG	SEE COUPLING DETAIL	
C1 & C2	2"	—	HALF CPLG	SEE COUPLING DETAIL	
D1 D2 D3	1"	—	HALF CPLG	SEE COUPLING DETAIL	SIGHT GLASS CONNECTIONS
E1 & E2	1"	—	HALF CPLG	SEE COUPLING DETAIL	SIGHT GLASS CONNECTIONS

NOTES:

1. MATERIAL: H.R. CARBON STEEL.
2. DESIGN & OPERATING PRESSURE: ATMOSPHERIC.
3. TANK TO BEAR MANUFACTURERS LABEL ONLY.
4. ALL OPENINGS TO BE PROTECTED FOR SHIPMENT.
5. INTERIOR: WIRE BRUSH & VACUUM.
6. EXTERIOR: COMMERCIAL SANDBLAST & APPLY ONE SHOP COAT RED OXIDE PRIMER.





MANWAY DETAIL
(A)

FOR APPROVAL

APPROVAL FOR CONSTRUCTION
PLEASE SIGN AND RETURN
☐ APPROVED AS DRAWN
☐ APPROVED WITH NOTED CHANGES
CONSTRUCTION WILL BEGIN WHEN SIGNED DRAWING IS RECEIVED

SIGNATURE.....

DATE.....

A REVISIONS MADE PER RANDERS FIELD INSPECTION 1-4-90 (NOT AS-BUILT DWG)

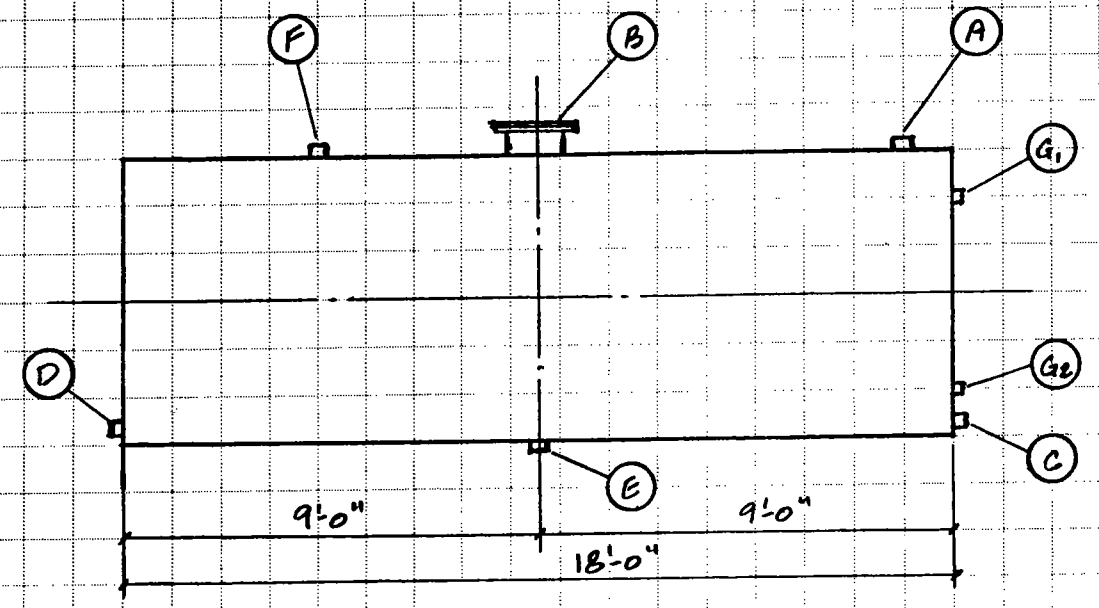
TOLERANCES	REVISIONS		
EXCEPT AS NOTED	NO.	DATE	BY
DECIMAL	1		
±	2		

HAMILTON WELDING CO.
COLUMBUS HAMILTON

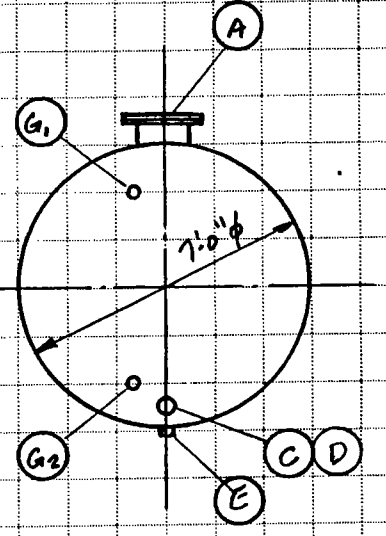
4500 GAL. VERT. STORAGE TANK
DETREX CHEMICAL IND., INC. P.O.# PE-003982

Randers Engineering
905 W. EISENHOWER CIRCLE, SUITE 102
ANN ARBOR, MI 48103
(313) 663-0420
FAX (313) 663-0120

JOB DETROIT - Job No. 89215
SHEET NO. _____ OF _____
CALCULATED BY DKP DATE 1-13-90
CHECKED BY _____ DATE _____
SCALE _____

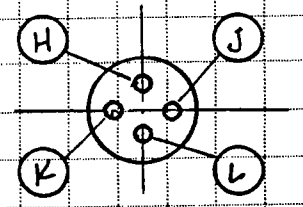


PLAN - 5000 GALLON STORAGE TANK
NO SCALE



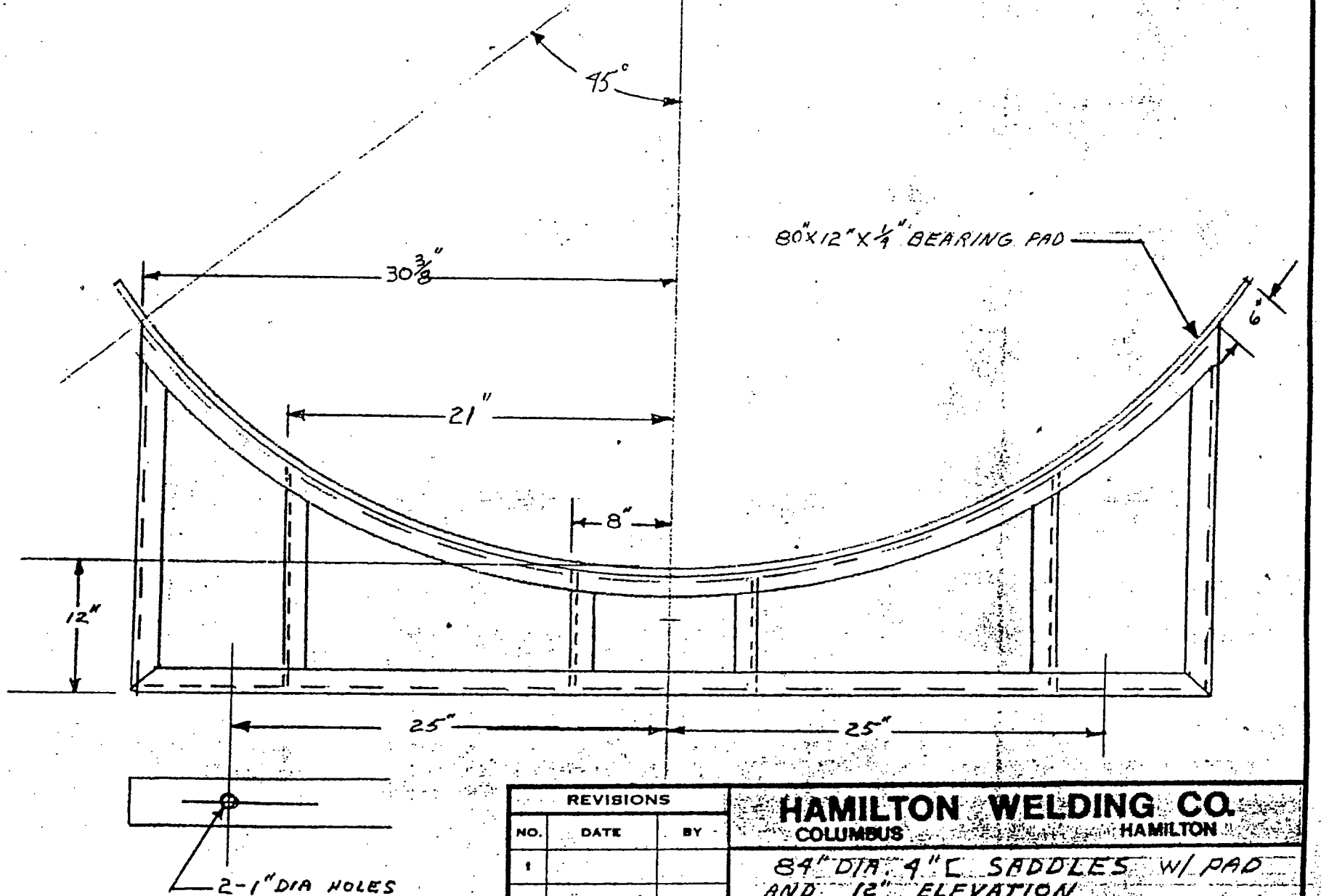
END VIEW
NO SCALE

ITEM	SIZE	REMARKS
A	3"	STD. HALF COUPLING
B	24"	MANHOLE
C	2"	STD HALF COUPLING
D	3"	" " "
E	2"	" " "
F	2"	" " "
G1, G2	3/4"	STD. COUPLING
H	2"	" "
J	2"	" "
K	2"	" "
L	3"	" "



PLAN - M.H. COVER

NOTES
1. SADDLE AS SHOWN ON HAMILTON WELDING CO. DRAWING (ATTACHED). TWO SADDLES SPACED AT APPROX. 9'-8".
2. NOZZLES D, F THRU L ADDED 1-3-90



REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		

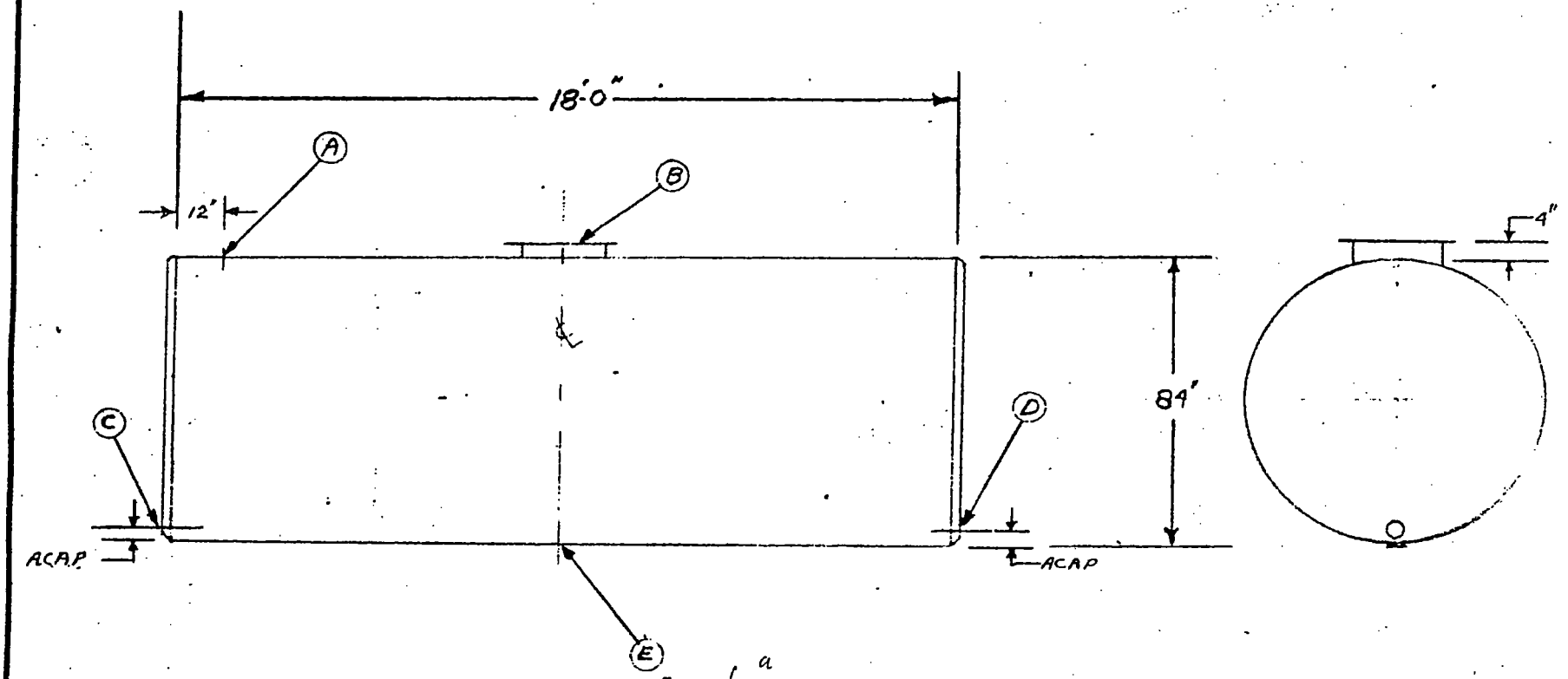
HAMILTON WELDING CO.
COLUMBUS HAMILTON

84" DIA. 4"C SADDLES W/ PAD AND 12" ELEVATION

DRAWN BY RS	SCALE N.T.S.	MATERIAL 4"C @ 5.4#
CHK'D	DATE 8-25-82	DRAWING NO. HT-82040-A-1
TRACED	APP'D	

NOTES:
1. MAT. ¼" HR. CARBON ST. - HEAD 5/16" FLAT + FLANGED
2. DESIGN @ OPER. PRESS. : ATMOS.
3. FINISH: EXTERIOR TO HAVE ONE COAT OF RED OXIDE
4. STD. 4" I SADDLES 12" HIGH W/BEARING PADS TO BE SHIPPED LOOSE.

ITEM	QTY.	SIZE	REMARKS
A	1	9" WF	
B	1	24"	STD. MANHOLE W/ LONG BOLTS
C	1	2" HALF CPL'G	STD.
D	1	"	STD.
E	1	"	STD. W/ PLUG



5000 HORIZ. ABOVE GROUND TANK
1- REQ'D

APPROX WT 5200#

APPROVAL FOR CONSTRUCTION
PLEASE SIGN AND RETURN
☑ APPROVED AS DRAWN
☐ APPROVED WITH NOTED CHANGES
CONSTRUCTION WILL BEGIN WHEN SIGNED DRAWING IS RECEIVED

SIGNATURE.....

DATE.....

REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		

HAMILTON WELDING CO.
COLUMBUS HAMILTON

FALLER & COMPANY
C/O DETREX CORP. P.O. #PE-001187

DRAWN BY RS	SCALE ¼" = 1'	MATERIAL
CHK'D	DATE 8-25-82	DRAWING NO.
TRACED	APP'D	HT-82040-A

Randers Engineering
INCORPORATED
ENGINEERS • ARCHITECTS • CONSULTANTS • PROJECT MANAGERS

May 11, 1990

Mr. Ronald Swan
Gold Shield Solvents Division
Detrex Corporation
12886 Eaton Avenue
Detroit, Michigan 48227

Subject: Atmospheric Storage Tank Certification

Dear Mr. Swan:

We have completed our review of the three storage tanks at your Eaton Avenue Plant and wish to report to you our assessment.

Based on the findings as detailed in our January 22, 1990 report and verification of the corrective measures performed to upgrade the supports, we provide certification that these tanks F-001, F-001/F-002 (Vertical Tanks) and F-002 (Horizontal Tank) can be utilized for their intended service.

As was mentioned on our January 22, 1990 report Randers Engineering recommends that each of these tanks be given an annual inspection including a shell thickness check.

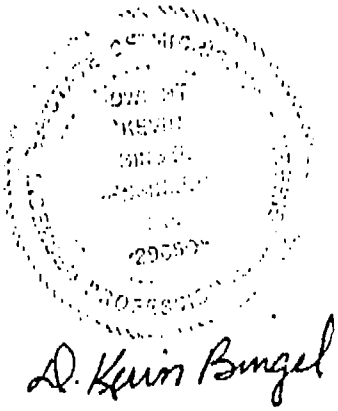
We trust that the above satisfies your requirements. Should you have any questions concerning the above or have any other need for our service do not hesitate to contact us.

Sincerely,
RANDERS ENGINEERING, INC.

D. Kevin Bingel

D. Kevin Bingel, P.E.
Vice President

DKB/jat



905 W. EISENHOWER CIRCLE, SUITE 102, ANN ARBOR, MI 48103 (313) 663-0420

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive,
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

September 20, 1991

Reference No. 2471

Ms. Rhonda L. Hall, Environmental Engineer
Hazardous Waste Permits Section
Waste Management Division
Michigan Department of Natural Resources
Ottawa Building South
608 West Allegan
Lansing, Michigan
U.S.A. 48909

Dear Rhonda:

Re: Background Soil and Groundwater Data Collection Program
Detrex Corporation

On behalf of Detrex Corporation, this letter presents the results of the recent soil and groundwater sampling program conducted at Detrex's Eaton Avenue facility in Detroit, Michigan. The sampling was conducted in accordance with the work plan entitled "Background Soil and Groundwater Data Collection Program", submitted to the Michigan Department of Natural Resources Waste Management Division (WMD) on August 7, 1991 and modifications requested by the WMD letter of approval dated August 13, 1991.

Soil Sampling and Analysis

Borehole drilling was completed on August 16, 1991 by McDowell & Associates under the supervision of CRA. Four boreholes were advanced to a total depth of ten feet below ground surface at the locations shown on Figure 1. The stratigraphy encountered in all boreholes included approximately 1.5 feet of fill, approximately 4 feet of native sand fill and clay. The upper surface of the clay formation was encountered ranging from 5'6" to 6'8" below ground surface and extended to the completed depth of the borehole. Attachment 1 presents stratigraphic logs of the four boreholes.

Perched groundwater was not encountered in any borehole during drilling.

A black staining was identified within the overlying native sand fill in each of the four soil borings. It is to be noted that observed staining was not identified in any of the three previous soil borings (including nearby BH-MW1-89) installed in April 1989 during the Hydrogeologic Investigation.

Continuous split-spoon samples were collected from each soil boring. Samples for chemical analyses were selected from the upper six inches of native sand fill, the lower six inches of native sand fill and the upper six inches of the underlying clay. Soil samples were submitted to Research Technology International (RTI) for chemical analyses. Table 1 summarizes detected compounds for the soil samples. The RTI analytical report is included as Attachment 2. A data validation was completed by CRA's Quality Assurance (QA) officer. A copy of the data validation report is provided in Attachment 3. The analytical results for the soil samples were determined to be acceptable without qualification based on the information provided by RTI. As noted on Table 1, the laboratory experienced high matrix interferences from the soil material in a number of the samples.

Subsequent to the receipt of the analytical results, a supplemental soil boring and sampling program was conducted. Boreholes BH5-91 and BH6-91 were advanced to a total depth of 14 and 16 feet below ground surface, respectively, to delineate the potential vertical depth of chemical presence. Borehole locations are shown on Figure 1. Stratigraphic logs are provided in Attachment 1.

Clay soil samples were collected from a depth of five feet and ten feet below the upper surface of the clay formation in accordance with the protocols established for the previous sampling. The samples were submitted to RTI for chemical analyses. Table 2 summarizes the detected compounds for the additional soil samples. The RTI analytical report is included in Attachment 2 and the data validation is reported in Attachment 3. Again, the soil results were determined to be acceptable without qualification.

Figure 2 illustrates total Volatile Organic Compound (VOC) concentrations in profile view for BH5-91 and BH6-91. Total VOC concentrations were calculated by summing detected values for each sample. For duplicate samples, an average of the results was utilized. To estimate the upper profile for BH5-91, average VOC concentrations for corresponding samples for BH3-91 and BH4-91 were used. Similarly, the average VOC concentrations for BH2-91 and BH3-91 were used to estimate the upper profile for BH6-91. The profiles illustrate the distribution of VOCs related to depth, particularly within the clay formation.

Groundwater Sampling and Analysis

On August 16, 1991, the on-Site groundwater monitoring well (MW-BH1-89) was purged and sampled. The well's potentiometric surface, prior to well purging, was

measured at 606.55 feet AMSL. This compares to 605.18 feet AMSL recorded during original well installation in April 1989.

In accordance with the work plan, the well was sampled in duplicate and a matrix spike/matrix spike duplicate sample and field rinsate sample were collected. A laboratory trip blank was also provided. As a result of a malfunction of the laboratory refrigeration system after receipt of the samples, only three of the investigative 40 mL sample bottles remained intact. The remaining investigative, field rinsate and trip blank bottles were broken by the freeze-up of the laboratory refrigerator. As a result, only one analysis and a duplicate analysis were possible.

Table 3 summarizes the detected compounds in the groundwater sample, the duplicate sample and two laboratory blanks. The RTI analytical report is included in Attachment 2. CRA's data validation of the groundwater results (see Attachment 3) requires the sample data to be qualified based on an initial calibration response outside acceptable limits. Thus, the analytical data results for the groundwater sample are qualified as estimated values.

With the indication of the potential presence of VOCs within the groundwater aquifer, a decision was made to conduct more extensive well development/purging followed by resampling in order to confirm the results.

A submersible pump was initially utilized during the second sampling event to increase the rate and volume of water purged prior to sampling. The original purging had been completed using a bailer and nylon rope. Shortly after initiating pumping with the submersible pump at a pumping rate of approximately 2 gallons per minute, a severe silt presence in the water was encountered which plugged the pump and prevented purging. An attempt to clean the silt from the well utilizing an air-lift pump was unsuccessful. Subsequently, a jetting tool was constructed and utilized which successfully cleaned the silt out of the well. The jetting tool consisted of a hose from a potable water supply attached to 110 feet of 1/2-inch diameter PVC rigid piping. A "T" fitting was attached to the surface of the well casing to direct purge water into the adjacent containment system for the Transfer Facility. By jetting water into the monitoring well, the heavy silt loading was suspended and forced up the annulus between the tubing and the monitoring well to be discharged into the containment system of the Transfer Facility.

A record was maintained of water injected into the well and water collected within the containment system to estimate potential water loss to the formation. An estimated total of 135 gallons was initially lost to the formation during jetting. Subsequently, a submersible pump was used to purge the well again prior to

re-sampling. During the purging, substantial quantities of silt were again encountered which plugged the submersible pump. Further attempts to clean the monitoring well by alternately removing silt using the jetting tool and purging using the submersible pump were unsuccessful. On September 18, 1991, further attempts to purge and re-sample the monitoring well were suspended. Throughout the well purging program a total net loss of water to the formation of approximately 60 gallons was recorded.

Conclusions

The results of the Background Soil and Groundwater Data Collection Program indicate a limited VOC presence within the sand fill and upper clay formation in the vicinity of the loading/unloading area. The degree of black staining identified in the sand fill was not extensive nor indicative of a substantial source of contamination. The additional soil sampling indicates that chemical presence within the clay formation does not extend very deep into the clay formation. The distribution of VOC presence in the profiles shown on Figure 2 indicates a significant reduction in VOC concentration with depth in the clay formation.

The findings of the Hydrogeologic Investigation reported within Section E of the TSD Facilitys' Act 64 Operating License Application indicated that the likelihood of transport of VOC compounds from the surface to the groundwater aquifer is extremely remote. Based on the results of this sampling program, CRA continues to support this finding.

There is present, above the groundwater aquifer, approximately 100 feet of very low permeability clay that would essentially eliminate the potential for downward migration to the aquifer. This assertion is confirmed by the significant decline of total VOC presence within only the upper 10 feet of the clay formation as shown on Figure 2. Furthermore, there is a strong upward gradient (approximately 50 feet of head) from the confined aquifer. This would serve to further preclude downward migration from the overlying material.

It should be recognized that the Detrex facility is located in an industrial area of Detroit and the chemicals identified within the aquifer are common industrial/commercial solvents. The extensive clay deposit overlying the aquifer and the high permeability of the sand zone indicate that the source of potential VOC presence in the aquifer beneath the Detrex facility may be a great distance away from the facility.

The presence of contamination within the underlying aquifer has not yet been confirmed from re-sampling, however, the assessment of hydrogeologic conditions does not indicate any likelihood of contamination being related to the TSD facility operations.

Recommendations

Based on the initial results of the Background Soil and Groundwater Data Collection Program, the following recommendations are made:

1) further attempts to purge and resample existing well MW-BH1-89 be completed, or alternatively, a replacement well be installed, developed and sampled;

2) a review of available hydrogeologic and geologic records for the region be conducted to further define conditions and determine groundwater flow direction; and

3) an upgradient location be selected and a new groundwater monitoring well installed. This well should be developed and sampled to assess groundwater quality upgradient of the Detrex facility.

Should you have any questions, do not hesitate to contact Mr. Bill Moore of Detrex Corporation or the undersigned at your convenience.

Sincerely,

CONESTOGA-ROVERS & ASSOCIATES

Bruce McConnell P.Eng.
BMC/br/11
Encl.

c.c. Bill Moore, Detrex
Issa Shamiyeh, Detrex
Bruce Monteith, CRA

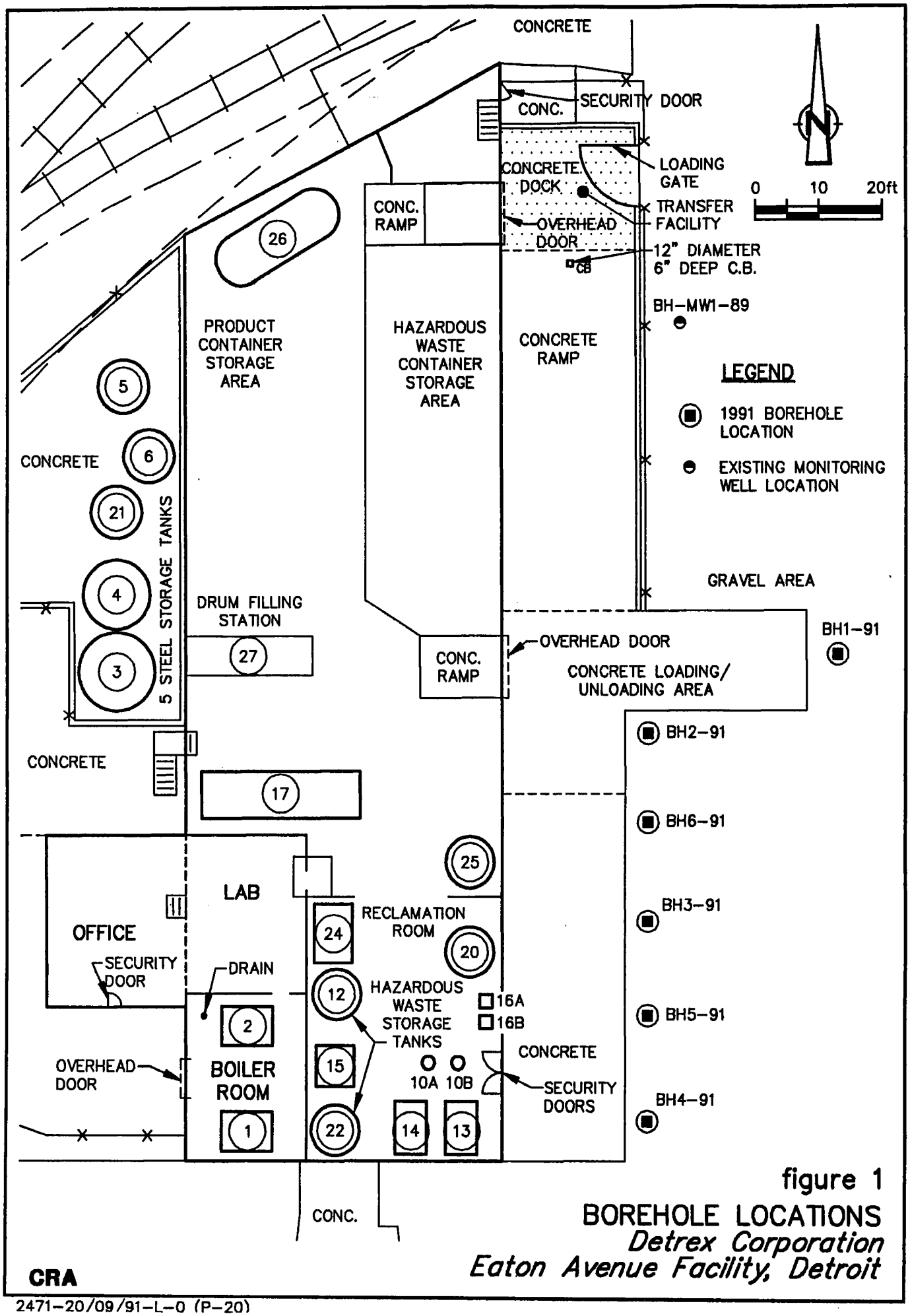


figure 1

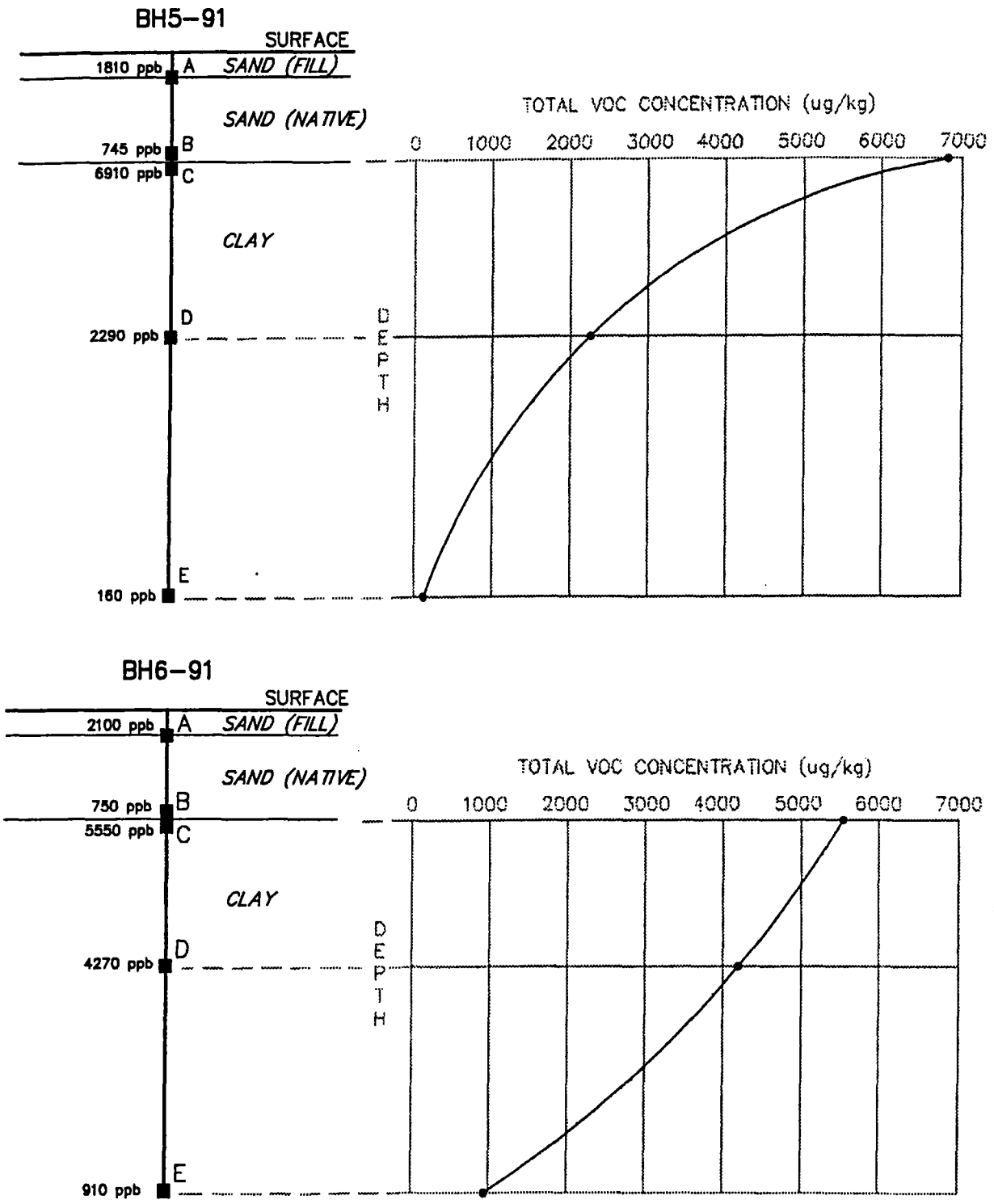
BOREHOLE LOCATIONS

Detrex Corporation

Eaton Avenue Facility, Detroit

CRA

2471-20/09/91-L-0 (P-20)



SAMPLE CODE:
A – UPPER SIX INCHES OF NATIVE SAND FILL
B – LOWER SIX INCHES OF NATIVE SAND FILL
C – UPPER SIX INCHES OF CLAY
D – FIVE FEET BELOW TOP OF CLAY
E – TEN FEET BELOW TOP OF CLAY

figure 2

TOTAL VOC CONCENTRATION – PROFILE

Detrex Corporation

Eaton Avenue Facility, Detroit

CRA

2471–20/09/91–L–0 (X–01)

TABLE 1

SUMMARY OF DETECTED COMPOUNDS - SOIL SAMPLING

Parameter (ug/kg)	*Sample Location (Sample Depth Below Ground Surface)*											
	BH1-91 (1'6" - 2'0")	*BH1-91 (5'9" - 6'3")*	*BH1-91 (7'2" - 7'8")*	*BH2-91 (1'6" - 2'0")*	*BH2-91 (5'6" - 6'0")*	*BH2-91 (6'0" - 6'6")*	*BH3-91 (1'6" - 2'0")*	*BH3-91 (5'0" - 5'6")*	*BH3-91 (5'6" - 6'0")*	*BH4-91 (2'6" - 3'0")*	*BH4-91 (6'2" - 6'8")*	*BH4-91 (6'8" - 7'2")*
vinyl chloride	ND10	ND10	ND10	ND10	*	100 [ND 10]	ND10	ND10	30	*	*	39
methylene chloride	ND5	ND5	ND5	ND5		>300 [120]	ND5	16	>1600			>2700
acetone	60	ND100	160	>800		34 [ND 100]	>1400	>470	120			ND100
1,1-dichloroethene	ND5	ND5	ND5	ND5		43 [27]	ND5	ND5	46			62
1,1-dichloroethane	ND5	ND5	ND5	19		>308 [108]	17	ND5	>340			>260
1,2-dichloroethene (total)	12	ND5	ND5	49		>3040 [>1300]	68	150	>1100			>1100
1,2-dichloroethane	ND5	ND5	ND5	ND5		ND5 [6]	ND5	ND5	ND5			ND5
1,1,1-trichloroethane	7	ND5	ND5	175		>1200 [>610]	16	24	>1400			>1200
trichloroethene	115	ND5	57	>1040		>750 [140]	>201	18	>390			>600
1,1,2-trichloroethane	28	ND5	ND5	ND5		17 [13]	ND5	5	25			68
tetrachloroethene	61	ND5	ND5	>300		200 [15]	110	55	>1800			>480
1,1,2,2-tetrachloroethane	5	ND5	ND5	ND5		ND5 [ND5]	ND5	ND5	ND5			ND5
toluene	ND5	ND5	ND5	ND5		60 [11]	ND5	6	60			73

Notes:

>	Value above standard linearity curve and are minimum values.
NDx	Parmater not detected above detection level x.
[ ]	Duplicate analysis.
*	Laboratory experienced serious matrix effects whereby compounds added for QA/QC (internal standards and surrogates) as well as organic compounds could not be detected.

TABLE 2

SUMMARY OF DETECTED COMPOUNDS - ADDITIONAL SOIL SAMPLING

Parameter (ug/kg)	*Sample Location (Sample Depth Below Top of Clay)*				
	BH5-91 (5')	*BH5-91 (10')*	*BH6-91 (5')*	*BH6-91 (10')*	*Soil Blank*
vinyl chloride	ND50 [ND50]	ND50	ND50	ND50	ND10
methylene chloride	80 [170]	40	370	30	ND5
acetone	ND500 [ND500]	ND500	530	740	ND100
1,1-dichloroethene	ND30 [ND30]	ND30	30	ND30	ND5
1,1-dichloroethane	40 [100]	ND30	160	ND30	ND5
1,2-dichloroethene (total)	920 [1800**]	80	2,000**	100	ND5
1,2-dichloroethane	ND30 [ND30]	ND30	ND30	ND30	ND5
1,1,1-trichloroethane	130 [190]	40	490	ND30	ND5
trichloroethene	250 [340]	ND30	380	40	ND5
1,1,2-trichloroethane	80 [100]	ND30	30	ND30	ND5
tetrachloroethene	200 [180]	ND30	250	ND30	ND5
1,1,2,2-tetrachloroethane	ND30 [ND30]	ND30	ND30	ND30	ND5
toluene	ND30 [ND30]	ND30	30	ND30	ND5

Notes:

NDx Parmater not detected above detection level x.

[ ] Duplicate analysis.

TABLE 3

SUMMARY OF DETECTED COMPOUNDS - GROUNDWATER SAMPLING

Parameters (ug/L)	*MW-BH1-89*	*Lab Blank #1*	*Lab Blank #2*
vinyl chloride	J150 [J160]	ND5	ND5
1,1-dichloroethane	J37 [J40]	ND1	ND1
1,2-dichloroethene (total)	J1200* [J1300*]	ND1	ND1
1,2-dichloroethane	JND1 [J2]	ND1	ND1
1,1,1-trichloroethane	J3 [J2]	ND1	ND1
trichloroethene	J25 [J24]	ND1	ND1
tetrachloroethene	J2 [J2]	ND1	ND1

Notes:

* Result reported from a 1:10 dilution.

NDx Parmater not detected above detection level x.

[ ] Duplicate analysis.

J Data qualified as estimated based on data validation review.

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-01)

PROJECT NAME: BACKGROUND DATA COLLECTION PROGRAM
PROJECT NO.: 2471
CLIENT: DETREX CORPORATION
LOCATION: DETROIT, MI

HOLE DESIGNATION: BH1-91
DATE COMPLETED: AUGUST 16, 1991
DRILLING METHOD: 4 1/4" ID HSA
CRA SUPERVISOR: M. GLIHA

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
2.5	SP-SAND(FILL), some slag, some gravel, fine grained, poorly graded loose, dry	-1.0	8"ø BOREHOLE CUTTINGS	1SS		34
5.0	SP-SAND(NATIVE), fine grained, loose, poorly graded, brown, dry, black stained - medium dense, moist			2SS		13
7.5	CL-CLAY, trace gravel, stiff, gray brown, moist, black stained - heavy black staining - trace sand and silt, very stiff	-6.3		3SS		9
10.0	END OF HOLE @ 10.0 FT. BGS	-10.0		4SS		6
				5SS		34
12.5						
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-02)

PROJECT NAME: BACKGROUND DATA COLLECTION PROGRAM
HOLE DESIGNATION: BH2-91

PROJECT NO.: 2471
DATE COMPLETED: AUGUST 16, 1991

CLIENT: DETREX CORPORATION
DRILLING METHOD: 4 1/4" ID HSA

LOCATION: DETROIT, MI
CRA SUPERVISOR: M. GLIHA

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	SLAG(FILL), some fine sand, loose, porous, dry	-1.0		1SS		7
2.5	SP-SAND(FILL), some gravel, some slag, fine grained, loose, poorly graded, moist, black stained	-3.2	8"ø BOREHOLE	2SS		12
5.0	SP-SAND (NATIVE), fine grained, medium dense, brown, moist, black stained Same, except medium grained, wet		CUTTINGS	3SS		10
7.5	CL-CLAY, trace sand, trace silt, trace gravel, shale, very stiff, gray brown, moist	-6.0		4SS		18
10.0	END OF HOLE @ 10.0 FT. BGS	-10.0		5SS		33
12.5						
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

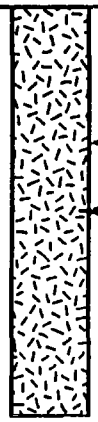
(L-03)

PROJECT NAME: BACKGROUND DATA COLLECTION PROGRAM
HOLE DESIGNATION: BH3-91

PROJECT NO.: 2471
DATE COMPLETED: AUGUST 16, 1991

CLIENT: DETREX CORPORATION
DRILLING METHOD: 4 1/4" ID HSA

LOCATION: DETROIT, MI
CRA SUPERVISOR: M. GLIHA

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	Slag(FILL), some sand, loose, dark, porous	-1.0		1SS		34
2.5	SP-SAND(FILL), some slag, some gravel, medium grained, loose, poorly graded, brown, moist - black stained	-3.3		2SS		27
	SP-SAND(NATIVE), fine grained, medium dense, poorly graded, moist, black stained	-4.5				
5.0	SW-SAND, fine to medium grained, loose, well graded, gray, wet	-6.5		3SS		8
7.5	CL-CLAY, trace sand, trace silt, stiff, gray brown, moist	-9.0		4SS		18
10.0	CL/ML-CLAY and SILT, trace sand and gravel, stiff, brown, moist	-10.0		5SS		28
	END OF HOLE @ 10.0 FT. BGS					
12.5						
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: BACKGROUND DATA COLLECTION PROGRAM
HOLE DESIGNATION: BH4-91

PROJECT NO.: 2471
DATE COMPLETED: AUGUST 16, 1991

CLIENT: DETREX CORPORATION
DRILLING METHOD: 4 1/4" ID HSA

LOCATION: DETROIT, MI
CRA SUPERVISOR: M. GLIHA

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	Crushed concrete	-0.8		1SS		42
2.5	SP-SAND(FILL), fine grained, dense, poorly graded, dark brown, dry, trace concrete	-2.5		2SS		21
5.0	SP-SAND(NATIVE), trace gravel, trace slag, loose, poorly graded, brown, wet, black stained		8"ø BOREHOLE; CUTTINGS	3SS		8
7.5	CL-CLAY, some silt, trace sand, trace gravel stiff, gray brown, moist	-6.7		4SS		22
10.0	CL/ML-CLAY and SILT, trace sand, very stiff, brown, moist	-9.0		5SS		31
	END OF HOLE @ 10.0 FT. BGS	-10.0				
12.5						
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-05)

PROJECT NAME: BACKGROUND DATA COLLECTION PROGRAM
HOLE DESIGNATION: BH5-91

PROJECT NO.: 2471
DATE COMPLETED: SEPTEMBER 11, 1991

CLIENT: DETREX CORPORATION
DRILLING METHOD: 4 1/4" ID HSA

LOCATION: DETROIT, MI
CRA SUPERVISOR: J. McCLELLAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	Crushed concrete, loose	-0.8				
2.5	SP-SAND(FILL), some gravel, fine grained, loose, poorly graded, brown	-3.0				
	SP-SAND(NATIVE), fine grained, dense, poorly graded, brown, black stained	-4.5				
5.0	CL-CLAY, some silt, little sand and gravel, very stiff, brown		8"ø BOREHOLE	1SS		31
7.5	- some gravel		CUTTINGS			
10.0						
12.5	- blue gray, pebbles			2SS		18
15.0	END OF HOLE @ 14.0 FT. BGS	-14.0				
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ · WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: BACKGROUND DATA COLLECTION PRO
PROJECT NO.: 2471
CLIENT: DETREX CORPORATION
LOCATION: DETROIT, MI

HOLE DESIGNATION: BH6-91
DATE COMPLETED: SEPTEMBER 11, 1991
DRILLING METHOD: 4 1/4" ID HSA
CRA SUPERVISOR: J. McCLELLAN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	SW/GW-SAND and GRAVEL(FILL), some crushed concrete, loose, brown	-0.7				
2.5	SP-SAND(NATIVE), some gravel, fine grained, poorly graded, black stained - some silt, gray, moist, slight odor	-4.0				
5.0	CL-CLAY, some sand, some gravel, mottled brown and gray - some silt		8"ø BOREHOLE	1SS		34
7.5	- mottled blue gray		CUTTINGS			
10.0						
12.5						
15.0	- some pebbles			2SS		20
17.5	END OF HOLE @ 16.9 FT. BGS	-16.9				
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

RESEARCH TECHNOLOGIES INTERNATIONAL

REPORT OF ANALYTICAL SERVICES

TO: CONESTOGA ROVER ASSOCIATES
651 COLBY DR.
WATERLOO, ONTARIO, CANADA N2V1C2

Report Date: 09/05/91

Lab Number: 91-6107A

Customer P.O. #

Customer Invoice #

Customer File #

Attn: Bruce McConnel

PART/SAMPLE IDENTIFICATION:

14 SOILS &
2 WATERS

TEST RECORDS:

Received: 08/27/91 Sample Prep. Completed: 08/26/91 Test Completed: 08/26/91

WORK REQUESTED/PERFORMED:

VOA analysis by GC/MS of each sample.

THE RESULTS OF ALL TESTS and/or ANALYSES REQUESTED ARE REPORTED ON THE PAGES WHICH FOLLOW.

Number of pages including this page 22.

APPROVED: J. B. Bodnar ANALYSTS:

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CONFIDENTIAL REPORT OF EVALUATION

Submitted by : Bruce McConnel

Lab. No. : 91-6107A

Customer/Client : CONESTOGA R.
ONTARIO, CAN

Report Date : 08/30/91

Part/Sample Identification : 14 SOILS &
2 WATERS

Object : VOA analysis by GC/MS of each sample.

Results and Discussion :

The submitted samples were analyzed for VOA content by GC/MS. The samples are as follows :

SAMPLE	DATE SAMPLED	TIME SAMPLED	DESCRIPTION
SMGBH1A	8/16/91	12:30 PM	1'6"-2'0"
SMGBH2A	8/16/91	11:45 AM	1'6"-2'0"
SMGBH3A	8/16/91	11:00 AM	1'6"-2'0"
SMGBH4A	8/16/91	9:45 AM	2'6"-3'0"
SMGBH1B	8/16/91	12:30 PM	5'9"-6'3"
SMGBH2B	8/16/91	11:45 AM	5'6"-6'0"
SMGBH3B	8/16/91	11:00 AM	5'0"-5"6"
SMGBH4B	8/16/91	9:45 AM	6'2"-6'8"
SMGBH1C	8/16/91	12:30 PM	7'2"-7'8"
SMGBH2C	8/16/91	11:45 AM	6'0"-6'6"
SMGBH3C	8/16/91	11:00 AM	5'6"-6'0"
SMGBH4C	8/16/91	9:45 AM	6'8"-7'2"
SMGBH1D	8/16/91	12:30 PM	7'0"-8'0"
SMGBH2D	8/16/91	11:45 AM	6'0"-7'0"
WJM0003	8/16/91		BH-MW1-89 WATER
WJM0006	8/16/91		BH-MW1-89 WATER

The data for each sample is attached hereto.

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Joe Terrell
Organics Group Leader

John Calado

Distribution :

BRUCE MCCONNEL

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH1A SOIL File : FN1377
Sample Description 8/16/91 12:30 P.M. 1'6"-2'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	60	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	<5	5
1,2-dichloroethene (total)	12	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	7	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	115	5
benzene	<5	5
1,1,2-trichloroethane	28	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	61	5
1,1,2,2-tetrachloroethane	5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH1B SOIL File : FN1381
Sample Description 8/16/91 12:30 P.M. 5'9"-6'3"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	<5	5
1,2-dichloroethene (total)	<5	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	<5	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	<5	5
benzene	<5	5
1,1,2-trichloroethane	<5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	<5	5
1,1,2,2-tetrachloroethane	<5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH1C SOIL File : FN1388
Sample Description 8/16/91 12:30 P.M. 7'2"-7'8"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	160	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	<5	5
1,2-dichloroethene (total)	<5	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	<5	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	57	5
benzene	<5	5
1,1,2-trichloroethane	<5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	<5	5
1,1,2,2-tetrachloroethane	<5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH1D SOIL File : FN1375
Sample Description 8/16/91 12:30 A.M. 7'0"-8'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane		
bromomethane		
vinyl chloride		
chloroethane		
methylene chloride		
acetone		
carbon disulfide		
1,1-dichloroethene		
1,1-dichloroethane		
1,2-dichloroethene (total)		
chloroform		
1,2-dichloroethane		
2-butanone		
1,1,1-trichloroethane		
carbon tetrachloride		
vinyl acetate		
bromodichloromethane		
1,2-dichloropropane		
bromoform		
2-hexanone		
4-methyl-2-pentanone		
trichloroethene		
benzene		
1,1,2-trichloroethane		
cis-1,3-dichloropropene		
tetrachloroethene		
1,1,2,2-tetrachloroethane		
toluene		
chlorobenzene		
ethylbenzene		
styrene		
xylenes (total)		
dibromochloromethane		
trans-1,3-dichloropropene		
2-chloroethyl vinyl ether		
ortho-dichlorobenzene		
trichlorotrifluoroethane		
trichlorofluoromethane		

Experienced serious matrix effects whereby compounds added for QA/QC (internal standards and surrogates) as well as any organic compounds present could not be detected.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH2A SOIL File : FN1376
Sample Description 8/16/91 11:45 A.M. 1'6"-2'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	800*	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	19	5
1,2-dichloroethene (total)	49	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	175	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	1040*	5
benzene	<5	5
1,1,2-trichloroethane	<5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	300*	5
1,1,2,2-tetrachloroethane	<5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH2B SOIL File : FN1380
Sample Description 8/16/91 11:45 A.M. 5'6"-6'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane		
bromomethane		
vinyl chloride		
chloroethane		
methylene chloride		
acetone		
carbon disulfide		
1,1-dichloroethene		
1,1-dichloroethane		
1,2-dichloroethene (total)		
chloroform		
1,2-dichloroethane		
2-butanone		
1,1,1-trichloroethane		
carbon tetrachloride		
vinyl acetate		
bromodichloromethane		
1,2-dichloropropane		
bromoform		
2-hexanone		
4-methyl-2-pentanone		
trichloroethene		
benzene		
1,1,2-trichloroethane		
cis-1,3-dichloropropene		
tetrachloroethene		
1,1,2,2-tetrachloroethane		
toluene		
chlorobenzene		
ethylbenzene		
styrene		
xylenes (total)		
dibromochloromethane		
trans-1,3-dichloropropene		
2-chloroethyl vinyl ether		
ortho-dichlorobenzene		
trichlorotrifluoroethane		
trichlorofluoromethane		

Experienced serious matrix effects whereby compounds added for QA/QC (internal standards and surrogates) as well as any organic compounds present could not be detected.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH2C SOIL File : FN1382
Sample Description 8/16/91 11:45 A.M. 6'0"-6'6"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	100	10
chloroethane	<10	10
methylene chloride	300*	5
acetone	34	100
carbon disulfide	<5	5
1,1-dichloroethene	43	5
1,1-dichloroethane	308*	5
1,2-dichloroethene (total)	3040*	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	1200*	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	750*	5
benzene	<5	5
1,1,2-trichloroethane	17	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	200	5
1,1,2,2-tetrachloroethane	<5	5
toluene	60	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH2D SOIL File : FN1394
Sample Description 8/16/91 11:45 A.M. 6'0"-7'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	120	5
acetone	<100	100
carbon disulfide	<5	5
1,1-dichloroethene	27	5
1,1-dichloroethane	180	5
1,2-dichloroethene (total)	1300*	5
chloroform	<5	5
1,2-dichloroethane	6	5
2-butanone	<100	100
1,1,1-trichloroethane	610*	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	140	5
benzene	<5	5
1,1,2-trichloroethane	13	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	15	5
1,1,2,2-tetrachloroethane	<5	5
toluene	11	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH3A SOIL File : FN1378
Sample Description 8/16/91 11:00 A.M. 1'6"-2'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	1400*	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	17	5
1,2-dichloroethene (total)	68	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	16	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	201*	5
benzene	<5	5
1,1,2-trichloroethane	<5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	110	5
1,1,2,2-tetrachloroethane	<5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH3B SOIL File : FN1390
Sample Description 8/16/91 11:00 A.M. 5'0"-5'6"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	16	5
acetone	470*	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	<5	5
1,2-dichloroethene (total)	150	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	24	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	18	5
benzene	<5	5
1,1,2-trichloroethane	5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	55	5
1,1,2,2-tetrachloroethane	<5	5
toluene	6	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH3C SOIL File : FN1391
Sample Description 8/16/91 11:00 A.M. 5'6"-6'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	30	10
chloroethane	<10	10
methylene chloride	1600*	5
acetone	120	100
carbon disulfide	<5	5
1,1-dichloroethene	46	5
1,1-dichloroethane	340*	5
1,2-dichloroethene (total)	1100*	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	1400*	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	390*	5
benzene	<5	5
1,1,2-trichloroethane	25	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	1800*	5
1,1,2,2-tetrachloroethane	<5	5
toluene	60	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH4A SOIL File : FN1379
Sample Description 8/16/91 9:45 A.M. 2'6"-3'0"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane		
bromomethane		
vinyl chloride		
chloroethane		
methylene chloride		
acetone		
carbon disulfide		
1,1-dichloroethene		
1,1-dichloroethane		
1,2-dichloroethene (total)		
chloroform		
1,2-dichloroethane		
2-butanone		
1,1,1-trichloroethane		
carbon tetrachloride		
vinyl acetate		
bromodichloromethane		
1,2-dichloropropane		
bromoform		
2-hexanone		
4-methyl-2-pentanone		
trichloroethene		
benzene		
1,1,2-trichloroethane		
cis-1,3-dichloropropene		
tetrachloroethene		
1,1,2,2-tetrachloroethane		
toluene		
chlorobenzene		
ethylbenzene		
styrene		
xylenes (total)		
dibromochloromethane		
trans-1,3-dichloropropene		
2-chloroethyl vinyl ether		
ortho-dichlorobenzene		
trichlorotrifluoroethane		
trichlorofluoromethane		

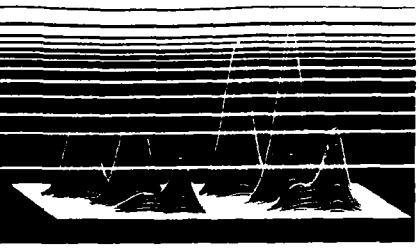
Experienced serious matrix effects whereby compounds added for QA/QC (internal standards and surrogates) as well as any organic compounds present could not be detected.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH4B SOIL File : FN1392
Sample Description 8/16/91 9:45 A.M. 6'2"-6'8"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane		
bromomethane		
vinyl chloride		
chloroethane		
methylene chloride		
acetone		
carbon disulfide		
1,1-dichloroethene		
1,1-dichloroethane		
1,2-dichloroethene (total)		
chloroform		
1,2-dichloroethane		
2-butanone		
1,1,1-trichloroethane		
carbon tetrachloride		
vinyl acetate		
bromodichloromethane		
1,2-dichloropropane		
bromoform		
2-hexanone		
4-methyl-2-pentanone		
trichloroethene		
benzene		
1,1,2-trichloroethane		
cis-1,3-dichloropropene		
tetrachloroethene		
1,1,2,2-tetrachloroethane		
toluene		
chlorobenzene		
ethylbenzene		
styrene		
xylenes (total)		
dibromochloromethane		
trans-1,3-dichloropropene		
2-chloroethyl vinyl ether		
ortho-dichlorobenzene		
trichlorotrifluoroethane		
trichlorofluoromethane		

Experienced serious matrix effects whereby compounds added for QA/QC (internal standards and surrogates) as well as any organic compounds present could not be detected.



VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID SMGBH4C SOIL File : FN1389
Sample Description 8/16/91 9:45 A.M. 6'8"-7'2"
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/22/91 Analyst JC & JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	39	10
chloroethane	<10	10
methylene chloride	2700*	5
acetone	<100	100
carbon disulfide	<5	5
1,1-dichloroethene	62	5
1,1-dichloroethane	260*	5
1,2-dichloroethene (total)	1100*	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	1200*	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	600*	5
benzene	<5	5
1,1,2-trichloroethane	68	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	480*	5
1,1,2,2-tetrachloroethane	<5	5
toluene	73	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50	50
trichlorofluoromethane	<50	50

Results are reported on a wet weight basis.
* Values above standard linearity curve and are minimum values.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID BLANK #1 File 1:FN1347
Sample Description WATER BLANK
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/20/91 Analyst JC & JT

Volatile Compound	Concentration (ug/L)	LOD (ug/L)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<5	5
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<1	1
1,1-dichloroethene	<1	1
1,1-dichloroethane	<1	1
1,2-dichloroethene (total)	<1	1
chloroform	<1	1
1,2-dichloroethane	<1	1
2-butanone	<100	100
1,1,1-trichloroethane	<1	1
carbon tetrachloride	<1	1
vinyl acetate	<50	50
bromodichloromethane	<1	1
1,2-dichloropropane	<1	1
bromoform	<1	1
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	<1	1
benzene	<1	1
1,1,2-trichloroethane	<1	1
cis-1,3-dichloropropene	<1	1
tetrachloroethene	<1	1
1,1,2,2-tetrachloroethane	<1	1
toluene	<1	1
chlorobenzene	<1	1
ethylbenzene	<1	1
styrene	<1	1
xylenes (total)	<1	1
dibromochloromethane	<1	1
trans-1,3-dichloropropene	<1	1
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<0.5	0.5
trichlorotrifluoroethane	<5	5
trichlorofluoromethane	<5	5

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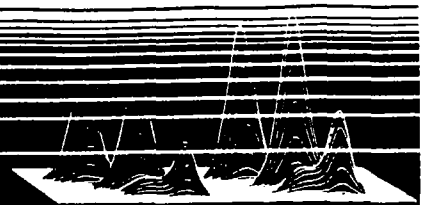

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID BLANK #2 File 1:FN1348
Sample Description WATER BLANK
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/20/91 Analyst JC & JT

Volatile Compound	Concentration (ug/L)	LOD (ug/L)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<5	5
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<1	1
1,1-dichloroethene	<1	1
1,1-dichloroethane	<1	1
1,2-dichloroethene (total)	<1	1
chloroform	<1	1
1,2-dichloroethane	<1	1
2-butanone	<100	100
1,1,1-trichloroethane	<1	1
carbon tetrachloride	<1	1
vinyl acetate	<50	50
bromodichloromethane	<1	1
1,2-dichloropropane	<1	1
bromoform	<1	1
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	<1	1
benzene	<1	1
1,1,2-trichloroethane	<1	1
cis-1,3-dichloropropene	<1	1
tetrachloroethene	<1	1
1,1,2,2-tetrachloroethane	<1	1
toluene	<1	1
chlorobenzene	<1	1
ethylbenzene	<1	1
styrene	<1	1
xylenes (total)	<1	1
dibromochloromethane	<1	1
trans-1,3-dichloropropene	<1	1
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<0.5	0.5
trichlorotrifluoroethane	<5	5
trichlorofluoromethane	<5	5

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID WJM-0003 File 1:FN1350 File 2:FN1353
Sample Description Detrex Corp BH-MW1-89 WATER
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/20/91 Analyst JC & JT

Volatile Compound	Concentration (ug/L)	LOD (ug/L)
chloromethane	<1	10
bromomethane	<10	10
vinyl chloride	150	5
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<1	1
1,1-dichloroethene	<1	1
1,1-dichloroethane	37	1
1,2-dichloroethene (total)	1200*	1
chloroform	<1	1
1,2-dichloroethane	<1	1
2-butanone	<100	100
1,1,1-trichloroethane	3	1
carbon tetrachloride	<1	1
vinyl acetate	<50	50
bromodichloromethane	<1	1
1,2-dichloropropane	<1	1
bromoform	<1	1
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	25	1
benzene	<1	1
1,1,2-trichloroethane	<1	1
cis-1,3-dichloropropene	<1	1
tetrachloroethene	2	1
1,1,2,2-tetrachloroethane	<1	1
toluene	<1	1
chlorobenzene	<1	1
ethylbenzene	<1	1
styrene	<1	1
xylenes (total)	<1	1
dibromochloromethane	<1	1
trans-1,3-dichloropropene	<1	1
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<0.5	0.5
trichlorotrifluoroethane	<5	5
trichlorofluoromethane	<5	5

* Result reported from a 1:10 dilution.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID WJM-0006 File 1:FN1352 File 2:FN1351
Sample Description Detrex Corp BH-MW1-89 WATER
Method EPA 8240 (Modified)
Date Received 8/16/91 Date Analyzed 8/20/91 Analyst JC & JT

Volatile Compound	Concentration (ug/L)	LOD (ug/L)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	160	5
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<1	1
1,1-dichloroethene	<1	1
1,1-dichloroethane	40	1
1,2-dichloroethene (total)	1300*	1
chloroform	<1	1
1,2-dichloroethane	2	1
2-butanone	<100	100
1,1,1-trichloroethane	2	1
carbon tetrachloride	<1	1
vinyl acetate	<50	50
bromodichloromethane	<1	1
1,2-dichloropropane	<1	1
bromoform	<1	1
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	24	1
benzene	<1	1
1,1,2-trichloroethane	<1	1
cis-1,3-dichloropropene	<1	1
tetrachloroethene	2	1
1,1,2,2-tetrachloroethane	<1	1
toluene	<1	1
chlorobenzene	<1	1
ethylbenzene	<1	1
styrene	<1	1
xylenes (total)	<1	1
dibromochloromethane	<1	1
trans-1,3-dichloropropene	<1	1
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<0.5	0.5
trichlorotrifluoroethane	<5	5
trichlorofluoromethane	<5	5

* Result reported from a 1:10 dilution.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6107 Sample ID WJM-0003
Sample Identification Duplicate run comparison
Method EPA 8240 (Modified)
Date Received 8/16/91 Date analyzed 8/20/91 Analyst JC & JT

Volatile Compound	FN1350 (1:10)	FN1353 (1:10)	% Difference
Vinyl chloride	150	140	7.14
1,1-Dichloroethane	38	36	5.26
1,2-Dichloroethene (total)	1000	1200	20.00
Trichloroethene	26	24	7.69

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REPORT OF ANALYTICAL SERVICES

TO: CONESTOGA ROVERS & ASSOCIATES
651 COLBY DR.
WATERLOO, ONT. CANADA N2V1C2

Report Date: 09/17/91
Lab Number: 91-6194A
Customer P.O. #
Customer Invoice #
Customer File #

Attn: ~~Bruce McConnell~~

PART/SAMPLE IDENTIFICATION:

5 Solid SJM
BH5 0001 -5

TEST RECORDS:

Received: 09/11/91 Sample Prep. Completed: 09/16/91 Test Completed: 09/17/91

WORK REQUESTED/PERFORMED:

VOC per SW846 Method 8240.

THE RESULTS OF ALL TESTS and/or ANALYSES REQUESTED ARE REPORTED ON THE PAGES WHICH FOLLOW.

Number of pages including this page 8.

APPROVED: ANALYSTS:

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CONFIDENTIAL REPORT OF EVALUATION

Submitted by : Bruce McConnell

Lab. No. : 91-6194A

Customer/Client : CONESTOGA R.
ONTARIO, CAN

Report Date : 09/17/91

Part/Sample Identification : 5 Solid SJM
BH5 0001 -5

Object : VOC per SW846 Method 8240.

Results and Discussion :

The submitted samples were analyzed for VOA content by SW846 Methond 8240. The results are attached hereto.

Distribution :

BRUCE MCCONNEL

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6194 Sample ID Blank File : FN1492
Sample Description Blank
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<10	10
bromomethane	<10	10
vinyl chloride	<10	10
chloroethane	<10	10
methylene chloride	<5	5
acetone	<100	100
carbon disulfide	<5	5
1,1-dichloroethene	<5	5
1,1-dichloroethane	<5	5
1,2-dichloroethene (total)	<5	5
chloroform	<5	5
1,2-dichloroethane	<5	5
2-butanone	<100	100
1,1,1-trichloroethane	<5	5
carbon tetrachloride	<5	5
vinyl acetate	<50	50
bromodichloromethane	<5	5
1,2-dichloropropane	<5	5
bromoform	<5	5
2-hexanone	<50	50
4-methyl-2-pentanone	<50	50
trichloroethene	<5	5
benzene	<5	5
1,1,2-trichloroethane	<5	5
cis-1,3-dichloropropene	<5	5
tetrachloroethene	<5	5
1,1,2,2-tetrachloroethane	<5	5
toluene	<5	5
chlorobenzene	<5	5
ethylbenzene	<5	5
styrene	<5	5
xylenes (total)	<5	5
dibromochloromethane	<5	5
trans-1,3-dichloropropene	<5	5
2-chloroethyl vinyl ether	<10	10
ortho-dichlorobenzene	<500	500
trichlorotrifluoroethane	<50 *	50 *
trichlorofluoromethane	<50	50

* Results are estimated.
Results are reported on a wet weight basis.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6194 Sample ID SJMBH5-0001 SOIL File: FN1497
Sample Description #2471 9/11/91 9:30 AM 1:5 Dilution
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<50	50
bromomethane	<50	50
vinyl chloride	<50	50
chloroethane	<50	50
methylene chloride	[illegible]	30
acetone	<500	500
carbon disulfide	<30	30
1,1-dichloroethene	<30	30
1,1-dichloroethane	[illegible]	30
1,2-dichloroethene (total)	[illegible]	30
chloroform	<30	30
1,2-dichloroethane	<30	30
2-butanone	<500	500
1,1,1-trichloroethane	[illegible]	30
carbon tetrachloride	<30	30
vinyl acetate	<300	300
bromodichloromethane	<30	30
1,2-dichloropropane	<30	30
bromoform	<30	30
2-hexanone	<300	300
4-methyl-2-pentanone	<300	300
trichloroethene	[illegible]	30
benzene	<30	30
1,1,2-trichloroethane	[illegible]	30
cis-1,3-dichloropropene	<30	30
tetrachloroethene	[illegible]	30
1,1,2,2-tetrachloroethane	<30	30
toluene	<30	30
chlorobenzene	<30	30
ethylbenzene	<30	30
styrene	<30	30
xylenes (total)	<30	30
dibromochloromethane	<30	30
trans-1,3-dichloropropene	<30	30
2-chloroethyl vinyl ether	<50	50
ortho-dichlorobenzene	<3000	3000
trichlorotrifluoroethane	<300 *	300 *
trichlorofluoromethane	<300	300

* Results are estimated.
Results are reported on a wet weight basis.

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6184 Sample ID SJMBH5-0002 SOIL File: FN1496
Sample Description #2471 9/11/91 9:30 AM 1:5 Dilution
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<50	50
bromomethane	<50	50
vinyl chloride	<50	50
chloroethane	<50	50
methylene chloride	[illegible]	30
acetone	<500	500
carbon disulfide	<30	30
1,1-dichloroethene	<30	30
1,1-dichloroethane	[illegible]	30
1,2-dichloroethene (total)	[illegible] **	30
chloroform	<30	30
1,2-dichloroethane	<30	30
2-butanone	<500	500
1,1,1-trichloroethane	[illegible]	30
carbon tetrachloride	<30	30
vinyl acetate	<300	300
bromodichloromethane	<30	30
1,2-dichloropropane	<30	30
bromoform	<30	30
2-hexanone	<300	300
4-methyl-2-pentanone	<300	300
trichloroethene	[illegible]	30
benzene	<30	30
1,1,2-trichloroethane	100	30
cis-1,3-dichloropropene	<30	30
tetrachloroethene	[illegible]	30
1,1,2,2-tetrachloroethane	<30	30
toluene	<30	30
chlorobenzene	<30	30
ethylbenzene	<30	30
styrene	<30	30
xylenes (total)	<30	30
dibromochloromethane	<30	30
trans-1,3-dichloropropene	<30	30
2-chloroethyl vinyl ether	<50	50
ortho-dichlorobenzene	<3000	3000
trichlorotrifluoroethane	<300 *	300 *
trichlorofluoromethane	<300	300

* Results are estimated. ** Over linearity range.
Results are reported on a wet weight basis.

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VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6184 Sample ID SJMBH5-0003 SOIL File: FN1495
Sample Description #2471 9/11/91 10:30 AM 1:5 Dilution
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<50	50
bromomethane	<50	50
vinyl chloride	<50	50
chloroethane	<50	50
methylene chloride	[illegible]	30
acetone	<500	500
carbon disulfide	<30	30
1,1-dichloroethene	<30	30
1,1-dichloroethane	<30	30
1,2-dichloroethene (total)	[illegible]	30
chloroform	<30	30
1,2-dichloroethane	<30	30
2-butanone	<500	500
1,1,1-trichloroethane	[illegible]	30
carbon tetrachloride	<30	30
vinyl acetate	<300	300
bromodichloromethane	<30	30
1,2-dichloropropane	<30	30
bromoform	<30	30
2-hexanone	<300	300
4-methyl-2-pentanone	<300	300
trichloroethene	<30	30
benzene	<30	30
1,1,2-trichloroethane	<30	30
cis-1,3-dichloropropene	<30	30
tetrachloroethene	<30	30
1,1,2,2-tetrachloroethane	<30	30
toluene	<30	30
chlorobenzene	<30	30
ethylbenzene	<30	30
styrene	<30	30
xylenes (total)	<30	30
dibromochloromethane	<30	30
trans-1,3-dichloropropene	<30	30
2-chloroethyl vinyl ether	<50	50
ortho-dichlorobenzene	<3000	3000
trichlorotrifluoroethane	<300 *	300 *
trichlorofluoromethane	<300	300

* Results are estimated.
Results are reported on a wet weight basis.

31628 GLENDALE AVENUE • LIVONIA, MI 48150 • (313) 422-8000 • FAX (313) 422-5342

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6194 Sample ID SJMBH6-0004 SOIL File: FN1494
Sample Description #2471 9/11/91 10:30 AM 1:5 Dilution
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<50	50
bromomethane	<50	50
vinyl chloride	<50	50
chloroethane	<50	50
methylene chloride	[illegible]	30
acetone	[illegible]	500
carbon disulfide	<30	30
1,1-dichloroethene	[illegible]	30
1,1-dichloroethane	[illegible]	30
1,2-dichloroethene (total)	[illegible]	30
chloroform	<30	30
1,2-dichloroethane	<30	30
2-butanone	<500	500
1,1,1-trichloroethane	[illegible]	30
carbon tetrachloride	<30	30
vinyl acetate	<300	300
bromodichloromethane	<30	30
1,2-dichloropropane	<30	30
bromoform	<30	30
2-hexanone	<300	300
4-methyl-2-pentanone	<300	300
trichloroethene	[illegible]	30
benzene	<30	30
1,1,2-trichloroethane	[illegible]	30
cis-1,3-dichloropropene	<30	30
tetrachloroethene	[illegible]	30
1,1,2,2-tetrachloroethane	<30	30
toluene	[illegible]	30
chlorobenzene	<30	30
ethylbenzene	<30	30
styrene	<30	30
xylenes (total)	<30	30
dibromochloromethane	<30	30
trans-1,3-dichloropropene	<30	30
2-chloroethyl vinyl ether	<50	50
ortho-dichlorobenzene	<3000	3000
trichlorotrifluoroethane	<300 *	300 *
trichlorofluoromethane	<300	300

* Results are estimated. ** Over linearity range.
Results are reported on a wet weight basis.

31628 GLENDALE AVENUE • LIVONIA, MI 48150 • (313) 422-8000 • FAX (313) 422-5342

RTI

RESEARCH TRIANGLE INSTITUTE

VOA COMPOUNDS

Company Detrex Corporation
Address Southfield, MI
Lab No. 91-6194 Sample ID SJMBH8-0005 SOIL File: FN1493
Sample Description #2471 9/11/91 9:30 AM 1:5 Dilution
Method EPA 8240 (Modified)
Date Received 9/11/91 Date Analyzed 9/16/91 Analyst JT

Volatile Compound	Concentration (ug/kg)	LOD (ug/kg)
chloromethane	<50	50
bromomethane	<50	50
vinyl chloride	<50	50
chloroethane	<50	50
methylene chloride	~~80~~	30
acetone	~~740~~	500
carbon disulfide	<30	30
1,1-dichloroethene	<30	30
1,1-dichloroethane	<30	30
1,2-dichloroethene (total)	~~400~~	30
chloroform	<30	30
1,2-dichloroethane	<30	30
2-butanone	<500	500
1,1,1-trichloroethane	<30	30
carbon tetrachloride	<30	30
vinyl acetate	<300	300
bromodichloromethane	<30	30
1,2-dichloropropane	<30	30
bromoform	<30	30
2-hexanone	<300	300
4-methyl-2-pentanone	<300	300
trichloroethene	~~40~~	30
benzene	<30	30
1,1,2-trichloroethane	<30	30
cis-1,3-dichloropropene	<30	30
tetrachloroethene	<30	30
1,1,2,2-tetrachloroethane	<30	30
toluene	<30	30
chlorobenzene	<30	30
ethylbenzene	<30	30
styrene	<30	30
xylenes (total)	<30	30
dibromochloromethane	<30	30
trans-1,3-dichloropropene	<30	30
2-chloroethyl vinyl ether	<50	50
ortho-dichlorobenzene	<3000	3000
trichlorotrifluoroethane	<300 *	300 *
trichlorofluoromethane	<300	300

* Results are estimated.
Results are reported on a wet weight basis.

31628 GLENDALE AVENUE • LIVONIA, MI 48150 • (313) 422-8000 • FAX (313) 422-5342

ATTACHMENT 3

CRA DATA VALIDATION

MEMO

TO: **Bruce McConnell**

FROM: **Bill Hamel**

REFERENCE NO. **2471/br**

DATE: **September 19, 1991**

RE: **Analytical Data Assessment and Validation**
Groundwater and Soil Samples Analyzed by RTI
Detrex Corporation, Southfield, MI

The following memo details an analytical data assessment and validation for one groundwater sample and 19 soil samples collected at the Detrex Site in Southfield, Michigan.

1.0 Groundwater Samples

One groundwater sample (BH-MW1-89) was collected on August 16, 1991 and submitted for VOC analysis by Method 8240, SW-846, 3rd Edition, 1986. Based on the analytical data reported by RTI, the following have been assessed for method compliance and technical validity:

i) Sampling holding times
ii) GC/MS tuning and performance data
iii) GC/MS initial calibration data
iv) GC/MS continuing calibration data
v) surrogate spike data
vi) method blank data

1.1 Sample Holding Times

The sample holding time requirement for VOCs in water samples is seven days from collection to analysis when unpreserved. Sample BH-MW1-89 was analyzed within four days of collection, thereby fulfilling this requirement.

1.2 GC/MS Tuning and Performance

The analysis of VOCs by Method 8240 is based on GC/MS techniques. To ensure that the data produced by the GC/MS instrument may be correctly interpreted, the tuning and performance criteria established in the method

have been assessed. These criteria have been established to ensure mass resolution, identification, and to some degree, sensitivity. A review of the GC/MS tuning data provided by RTI indicated that all tuning and performance criteria for bromofluorobenzene (BFB) were met for the analyses of VOCs.

1.3 GC/MS Initial Calibration

To assess the validity of the initial calibrations, the average relative response factors (RRFs) and Relative Standard Deviations (RSDs) of system performance check compounds (SPCCs) and calibration check compounds (CCCs) have been assessed. The criteria by which these data have been evaluated are as follows:

i) all SPCCs must demonstrate average RRFs greater than 0.300 (bromoform >0.250); and
ii) all CCCs must demonstrate RSDs less than 30 percent.

One SPCC (chloromethane) yielded an average RRF below than minimum value of 0.300.

The SPCCs are used to check compound stability which indicates the validity of the initial calibration. Therefore, failure to meet the compliance criteria for these compounds may affect the quantitation of all TCL compounds. Consequently, all sample data generated from an initial calibration which shows outlying SPCC criteria should be qualified as follows:

i) positive results are qualified as estimated (data qualifier J); and
ii) negative (non-detected) results are qualified as estimated (data qualifier J).

All remaining SPCCs yielded acceptable initial calibration data. All initial calibration criteria were met for CCCs.

1.4 GC/MS Continuing Calibration

To ensure that the initial calibrations remained valid during sample analysis, the percent difference of CCCs RRFs between the initial and continuing calibration was assessed. In addition, the RRF of a 50 nanogram continuing calibration check standard (RRF 50) was assessed for SPCCs. The criteria by which these data have been evaluated are as follows:

i) all SPCCs must demonstrate RRF 50 greater than 0.300 (bromoform >0.250); and
ii) all CCCs must demonstrate percent differences less than 25 percent.

One SPCC (chloromethane) yielded an RRF 50 below the minimum value of 0.300. However, all VOC data has been qualified due to outlying initial calibration data for this SPCC. Therefore, further qualification of the associated sample data was not required on this basis. All remaining SPCCS yielded acceptable continuing calibration data.

All CCCs yielded acceptable continuing calibration data.

1.5 Surrogate Spike Recoveries

Sample BH-MW1-89 was spiked with surrogate compounds prior to sample preparation to evaluate overall performance and efficiency of the analytical extraction procedure. In accordance with method 8240, BH-MW1-89 was spiked with the surrogate compounds toluene-d8, bromofluorobenzene, and 1,2-dichloroethane-d4. BH-MW1-89 yielded surrogate recoveries within the method control limits. Therefore, qualification of the sample data was not required on this basis.

1.6 Method Blank Analyses

Contamination of samples contributed by laboratory conditions or procedures was monitored by the concurrent preparation and analysis of method blanks samples. All method blanks submitted for VOC analyses yielded non-detected concentrations of the VOCs of interest. Therefore, the potential for sample contamination attributable to laboratory conditions or procedures was minimal during these analyses.

1.7 Laboratory Duplicate Analyses

The method precision is determined from the analysis of duplicate samples. The duplicate analysis of BH-MW1-89 yielded relative percent differences less than 20 percent for all compounds detected. This indicated acceptable analytical precision of the methodology.

2.0 Soil Samples (Collected August 16, 1991)

Fourteen soil samples were collected on August 16, 1991 and submitted for VOC analyses by Method 8240, SW-846, 3rd Edition, 1986. These samples are presented below:

SMGBH 1A	SMGBH 2D
SMGBH 1B	SMGBH 3A
SMGBH 1C	SMGBH 3B
SMGBH 1D	SMGBH 3C

SMGBH 2A	SMGBH 4A
SMGBH 2B	SMGBH 4B
SMGBH 2C	SMGBH 4C

Sample results which are flagged with an "*" exceeded the linear range of the calibration curve and should be considered estimated.

Based on the analytical data reported by RTI, the following have been assessed for method compliance and technical validity:

i) sample holding times; and
ii) method blank data.

2.1 Sample Holding Times

The sample holding time requirements for VOCs in soil samples is 14 days from collection to analysis. All soil samples were analyzed within six days of collection, thereby fulfilling this requirement.

2.2 Method Blank Analyses

Contamination of samples contributed by laboratory conditions or procedures was monitored by the concurrent preparation and analysis of method blank samples. All method blank samples submitted for VOC analysis yielded non-detected quantities for the VOCs of interest. Therefore, the potential for sample contamination attributable to laboratory conditions or procedures was minimal during these analyses.

3.0 Soil Samples (Collected September 11, 1991)

Five soil samples were collected on September 11, 1991 and submitted for VOC analyses by Method 8240, SW-846, 3rd Edition, 1986. These samples are presented below:

SJMBH5-0001	SJMBH5-0004
SJMBH5-0002	SJMBH5-0005
SJMBH5-0003	

All Trichlorotrifluoroethane results for these samples are estimated.

Sample results which are flagged with "**" exceeded the linear range of the calibration curve and should be considered estimated.

Based on the analytical data reported by RTI, the following have been assessed for method compliance and technical validity:

i) Sample holding times;
ii) Method blank data; and
iii) Field duplicate data.

3.1 Sample Holding Times

The sample holding time requirements for VOCs in soil samples is 14 days from collection to analysis. All soil samples were analyzed within five days of collection, thereby fulfilling this requirement.

3.2 Method Blank Analyses

Contamination of samples contributed by laboratory conditions or procedures was monitored by the concurrent preparation and analysis of method blanks samples. All method blanks submitted for VOC analyses yielded non-detected concentrations of the VOCs of interest. Therefore, the potential for sample contamination attributable to laboratory conditions or procedures was minimal during these analyses.

3.3 Field Duplicate Samples

In order to assess the aggregate analytical and sampling protocol precision, a field duplicate of SJMBH5-001 was collected and labeled SJMBH5-0002. Presented below are the positive results:

VOC	*SJMBH5-0001 (ug/kg)*	*SJMBH5-0002 (ug/k)*	*RPD (1)*
Methylene chloride	80	170	72
1,1-Dichloroethene	40	100	86
1,1-Dichloroethane	920	1800	65
1,1,1-Trichloroethane	130	190	37.5
Trichloroethene	250	340	31
1,1,2-Trichloroethane	80	100	22
Tetrachloroethane	200	180	11

Note:
(1) Relative percent difference.

Four of the above-mentioned detections showed RPDs greater than the control limit of 35 percent for soil matrices. These discrepancies in the field duplicate data may be attributable to the heterogeneity of the sample (matrix) as small changes in the matrix may have a substantial effect on the reproducibility of the data. Therefore, it is recommended that all sample results showing RSDs greater than 35 percent be qualified as estimated (data qualifier J) due to variability among the sample data.

4.0 Conclusion

Based on the review of the analytical data and deliverables provided by RTI, these sample data are acceptable for use with the specific qualifications noted herein. However, it should be noted that the analytical data and deliverables reported by RTI were incomplete. A more detailed review is recommended upon receipt of these data.

DETREX CORPORATION
CHEMICALS DIVISION • P. O. BOX 1398 • ASHTABULA, OHIO 44004
TELEPHONE 216 997-6131

January 18, 1989

Mr. David M. Petrovski
U S Environmental Protection Agency
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. Petrovski:

Early in December 1988, you verbally requested additional information to complete the EPA assesment of the Detrex TSD facility located in Detroit, Michigan. I am sorry about the delay in providing the information requested, but some of the data was not readily available.

The answers to your questions and the information you require is listed below.

Freon Drum Lining Material: Freon is shipped in drums lined with an epoxy-phenolic material. I have enclosed a MSDS for the coating material and solvents used during application of the coating.

Tank and Equipment Capacities: The capacities listed in the Part B application are correct. The capacities quoted to you during your visit to the facility were only approximate values.

Containment Volume Layout Drawing-Enclosed is a plan view of the Detroit TSD facility showing locations of the "parts" used to arrive at the maximum containment volume.

Flow & Process Description-Enclosed is a description of our waste recycling operation as done at the Detroit TSD facility. This description follows the flow outline supplied in the Part B application.

If you require any additional information or clarification of the material enclosed with this letter please advise.

Sincerely,

Charles U. Guy
Manager Environmental Compliance

CG/dmd

Enclosure

COPY 2

#14

MATERIAL SAFETY DATA SHEET

INDUSTRIAL COATINGS

62

Section I

MANUFACTURER'S NAME	EMERGENCY PHONE NO.
INMONT CANADA LIMITED	(416) 534-3571

STREET ADDRESS (No., City, State, Zip)
303 CAMPBELL AVENUE, TORONTO, ONTARIO, M6P 3V8

PRODUCT CLASS	TRADE NAME
MODIFIED EPOXY LINER	5B102 BROWN EPOXY LINER

MANUFACTURERS CODES
M63NT004

Section II — HAZARDOUS INGREDIENTS

	THRESHOLD LIMIT VALUE TLV:TWA (ppm)
Cellosolve Acetate	5
Toluol	100
Methyl Ethyl Ketone	200
Isopropyl Alcohol	400
Diacetone Alcohol	50
Normal Butyl Alcohol	50

Section III — PHYSICAL DATA

BOILING RANGE 167-337 F°		APPEARANCE BROWN PAINT	TYPE OF ODO KETONE & AI MATIC SOLV
VAPOR DENSITY: HEAVIER ☒ LIGHTER ☐	vs. air	EVAPORATION RATE vs. Butyl Acetate — FASTER	
LIQUID DENSITY: HEAVIER ☒ LIGHTER ☐	vs. water	SLOWER	XXX
		PERCENT VOLATILE WT.	60 ± 2%

Section IV — FIRE & EXPLOSION DATA

FLASH POINT CATEGORY (OSHA)	1B	LOWEST FLASH POINT	23°F	LOWER EXPLOSIVE LIMIT	1.0

EXTINGUISHING MEDIA — Carbon Dioxide, Dry Chemical, or alcohol foam.

SPECIAL FIRE FIGHTING PROCEDURE:

None. - Use water spray to keep containers in vicinity cool.

USUAL FIRE & EXPLOSION HAZARDS

Exposure to containers to excessive heat may cause disruptive pressure.

Section V — HEALTH HAZARD DATA

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[redacted]S-U.S. OCCUPATIONAL STANDARD FOR WORKPLACE AIR (TLV)

See Section II.

EFFECTS OF OVEREXPOSURE:

Prolonged breathing can cause dizziness, nausea, weakness, headache and/or drowsiness.

EMERGENCY FIRST AID:

If Swallowed: Do not induce vomiting - call physician.
Eye Contact: Flush with copious amounts of water - get medical attention.
Skin Contact: Wash affected area with water, remove contaminated clothing. If irritation persists, get medical attention.
Inhalation: Remove victim to fresh air, restore breathing, keep warm, call a physician.

Section VI — REACTIVITY DATA

PRODUCT STABILITY	STABLE	UNSTABLE
	XXX	

CONDITIONS TO AVOID

High temperature or heat.

Section VII — SPILL OR LEAK PROCEDURES

PROCEDURE WHEN MATERIAL SPILLED OR RELEASED

Ventilate area, eliminate all ignition sources; take up with inert absorbent.

WASTE DISPOSAL METHOD

Flammable waste procedures. Normally incineration.

Section VIII — SPECIAL PROTECTION INFORMATION

VENTILATION

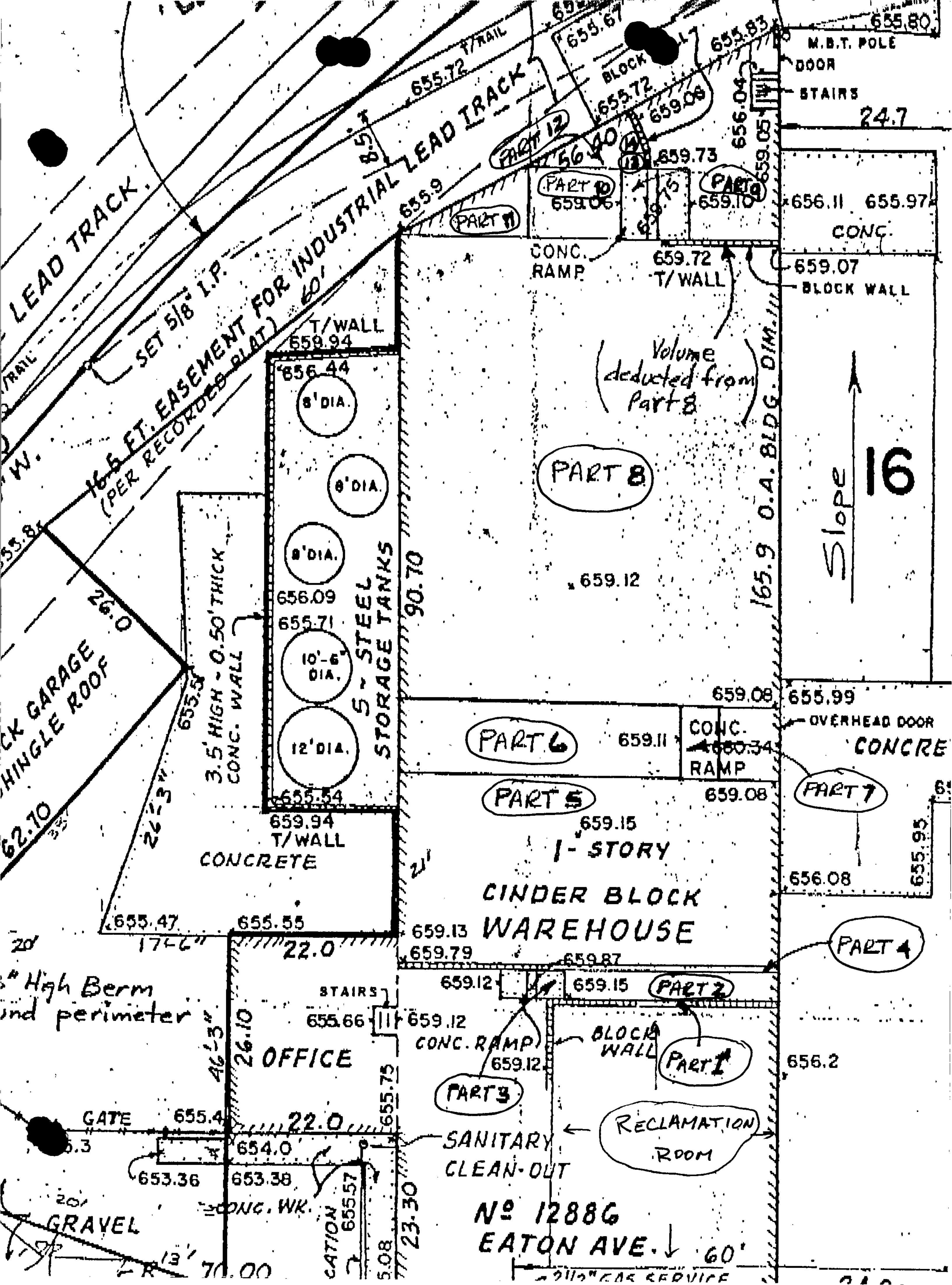
Ventilate to stay below TLV's and LEL's. See Section II and IV.

[redacted]ROTECTIVE EQUIPMENT; RESPIRATORY, EYE, ETC.

Safety glasses or goggles. Insoluble rubber gloves, and apron.
[redacted] Spray Application: Use N.I.O.S.H. approved mask for particulate and organic vapor to prevent inhalation of overspray.

Section IX — SPECIAL PRECAUTIONS

[redacted]TORAGE & HANDLING



LEAD TRACK
T/RAIL
655.72
LEAD TRACK
8.5'
SET 5/8" I.P.
16.5 FT. EASEMENT FOR INDUSTRIAL LEAD TRACK
(PER RECORDED PLAT) 60'
655.9
655.67
BLOCK
655.72
659.09
PART 12
656.90
14
13
659.73
655.83
655.80
M.B.T. POLE
DOOR
STAIRS
24.7
656.04
659.05
PART 10
659.06
659.75
PART 9
659.10
PART 11
656.11
655.97
CONC.
CONC. RAMP
659.72 T/WALL
659.07
BLOCK WALL
T/WALL
659.94
656.44
8' DIA.
8' DIA.
8' DIA.
10'-6" DIA.
12' DIA.
656.09
655.71
655.54
5 - STEEL STORAGE TANKS
90.70
Volume deducted from Part 8
PART 8
659.12
165.9 O.A. BLDG. DIM.
Slope
16
655.8
26.0
CK GARAGE
HINGLE ROOF
62.70
24'-3"
655.5
3.5' HIGH - 0.50' THICK CONC. WALL
659.94
T/WALL
CONCRETE
655.47
655.55
17'-6"
22.0
20'
659.08
655.99
OVERHEAD DOOR
CONCRE
PART 6
659.11
CONC.
660.34
RAMP
PART 5
659.08
PART 7
659.15
1-STORY
CINDER BLOCK
WAREHOUSE
21'
656.08
655.95
659.13
659.79
659.87
PART 4
659.12
659.15
PART 2
" High Berm
und perimeter "
STAIRS
655.66
659.12
46'-3"
26.10
OFFICE
CONC. RAMP
659.12
BLOCK WALL
PART 1
656.2
PART 3
655.75
GATE
655.4
22.0
.3
654.0
653.36
653.38
SANITARY
CLEAN-OUT
RECLAMATION ROOM
20'
GRAVEL
CONC. WK.
655.57
23.30
5.08
CATION
Nº 12886
EATON AVE.
60'
13'
70.00
2 1/2" GAS SERVICE

Waste Recycling Operation

Gold Shield Solvents recovers solvents from hazardous waste streams, via flash distillation and steam distillation. Hazardous wastes are received at the facility in bulk tank trailers and 55 gallon drums. Upon receipt, all drums are dated, sampled and transferred to the appropriate area in the hazardous waste container storage area to await recycling. Bulk shipments are sampled at the generator's site and analyzed prior to their being received at the Gold Shield facility.

Once the drum contents have been identified by specific gravity and/or chromatographic analysis, drums containing the same solvent (ie TCE) are transferred to the recycling area for processing.

Pre-shipment sampling and analysis is required on all bulk shipment because they must be processed immediately on receipt as the facility does not have F001 or F002 hazardous waste storage tanks.

The waste to be recycled, either drummed or bulk, is charged into the F001 feed tank and then fed into the two Detrex stills where the majority of the solvent is removed by heating the material with indirect steam. As the still level falls additional waste is introduced until the still reboiler contains essentially still bottoms with a small amount of solvent. At this point the hot still bottoms are transferred to the DCI feed tank and fed to the DCI stills. The residual solvent in the bottoms is removed by introducing live steam into the still reboiler. After the residual solvent has been removed, the stripped bottoms are transferred to the bottoms tank to await final disposal. The above cycles are repeated over and over again until all of the available similar waste (ie TCE) has been processed.

Processing of 1,1,1 trichloroethane, PCE, etc. hazardous wastes, to recover the solvent content, is done in a similar manner.

5HR-13

NOV 1 0 1988

Mr. C. U. Guy
Manager of Environmental Compliance
P.O. Box 1398
Ashtabula, Ohio 44004

Re: RCRA Facility Assessment
Gold Shield Solvents
Detrex Corporation
MID 091 605 972

Dear Mr. Guy:

The Hazardous and Solid Waste Amendments of 1984 (HSWA) to the Resource Conservation and Recovery Act (RCRA) contain provisions that the State of Michigan is not authorized to implement pursuant to Act 64. A Federal HSWA Permit must be prepared for your facility and will be issued concurrent with the Act 64 Operating License. The RCRA Facility Assessment (RFA) constitutes the first step in the HSWA permitting process. The RFA includes a Preliminary Review (PR) of available file information, a Visual Site Inspection (VSI) of the facility, and if necessary, a Sampling Visit (SV).

As has been discussed in a recent telephone conversation with a member of my staff, a VSI of your facility will be conducted on Tuesday, November 15, 1988. The purpose of the VSI is to fill in data gaps identified in the PR; ensure that all Solid Waste Management Units (SWMUs) and areas of concern have been identified; visually inspect the entire facility for evidence that releases of hazardous waste or hazardous constituents have occurred; and focus recommendations concerning the need for further action at the facility. In addition, photographs will be taken at all SWMUs and any areas of concern.

Should you have further questions regarding this matter, please contact Mr. David Petrovski, at (312) 886-0997.

Sincerely,

ORIGINAL SIGNED BY/
HAK K. CHO

Karl E. Bremer, Chief
RCRA Permitting Branch

cc: Ken Burda, MDNR

YELLOW

#12

bcc: D. Petrovski
R. Traub
File

5HR-13:PETROVSKI:js:6/6161:11/8/88:PC Disk B:\GUY

RCRA PERMITS	TYP.	AUTH.	IL. CHIEF	IN. CHIEF	MI. CHIEF	MN/WI CHIEF	OH. CHIEF	RPB CHIEF	O.R. A.D.D.	WMD DIR
INIT. DATE	11/8/88	11/8/88			11/10/88			11/10/88		

YELLOW

MAY 3 0 1989

5HR-13

Kenneth J. Burda, Chief
Hazardous Waste Permits Section
Waste Management Division
Michigan Department of Natural
Resources
P.O. Box 30028
Lansing, Michigan 48909

Dear Mr. Burda:

Enclosed for review is a copy of the RCRA Facility Assessment (RFA) for the Detrex facility in Detroit, Michigan.

If you have any comments, please contact Mr. David Petrovski at (312) 886-0997.

Sincerely,

ORIGINAL SIGNED BY/
RICHARD TRAUB

Richard Traub, Chief
Michigan Permitting Section

Enclosure

cc: Charles Guy, Detrex

5HR:PETROVSKI:fmd:5/22/89

Computer Disc #1:A:gold.ltr

RCRA PERMITS	TYP.	AUTH.	IL. CHIEF	IN. CHIEF	MI. CHIEF	MN/WI CHIEF	OH. CHIEF	RPB CHIEF	O.R. A.D.D.	WI
INIT. DATE	5/22/89	5/30/89			5/30/89					

#1

RCRA FACILITY ASSESSMENT (RFA)

PRELIMINARY REVIEW/VISUAL SITE INSPECTION

PR/VSI REPORT

GOLD SHIELD SOLVENTS/DETREX CORPORATION

DETROIT, MICHIGAN

MID 091 605 972

PREPARED BY

DAVID M. PETROVSKI

GEOLOGIST

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

230 SOUTH DEARBORN

CHICAGO, ILLINOIS 60604

I. RCRA FACILITY ASSESSMENT (RFA) SYNOPSIS

A. PURPOSE

The RCRA Corrective Action authorities were established under the Hazardous and Solid Waste Amendments (HSWA) of 1984, and consist of:

3004 (u) - Corrective action for continuing releases
3004 (v) - Corrective action beyond the facility boundary
3008 (h) - Corrective action at Interim Status facilities

The primary objective of the RCRA Corrective Action Program is the remediation of releases of hazardous wastes or hazardous constituents which threaten human health or the environment. Corrective Action under RCRA is a four phase process consisting of:

1. RCRA Facility Assessment (RFA)
2. RCRA Facility Investigation (RFI)
3. Corrective Measures Study (CMS)
4. Corrective Measure Implementation (CMI)

In turn, the RFA is divided into three phases:

1. Preliminary Review (PR)
2. Visual Site Inspection (VSI)
3. Sampling Visit (SV) (when necessary)

The purpose of the RFA is to:

- Identify and collate available information on release/s at RCRA facilities;

- Evaluate the Solid Waste Management Units (SWMUs) and other areas of concern for release/s at the site;

- Generate preliminary determinations regarding release/s from SWMUs and areas of concern, and the need for further investigation and/or interim measures; and,

- Eliminate those SWMUs/areas which are not a threat to human health or the environment.

B. SCOPE

The RFA attempts to identify releases from all SWMUs and areas of concern to all media, i.e., the atmosphere, surface water, ground water, soils and sediments. Note however, that releases to ground water from regulated units are not addressed under RCRA Corrective Action. Releases to ground water are regulated under 40 CFR 264/265 Subpart F.

II. EXECUTIVE SUMMARY

The Detrex Gold Shield Solvents facility is located at 12886 Eaton Avenue in Detroit. The facility specializes in the recovery (recycling) of spent solvents from sludges generated in degreasing operations and the sale of halogenated solvents. The facility is seeking a permit for a hazardous waste drum storage area.

During the PR/VSI phase of the RFA, U.S. EPA investigators observed/gathered information on thirteen SWMUs at the facility, including the hazardous waste container storage area. All the SWMUs are located within the main structure at the facility, and no evidence of release/s was observed. Based upon this information, a sampling visit is not required and corrective action at the identified SWMUs is unnecessary.

III. PRELIMINARY REVIEW

A. PURPOSE

The purpose of the PR is to gather and evaluate the existing information on the facility in order to identify and characterize potential release/s. The information collected in the PR is also used to focus the activities conducted in the VSI and potential activities during the SV.

B. SCOPE

The scope of the PR is the identification and evaluation of release/s to all environmental media resulting from waste management activities subject to other U.S. EPA and State authorities, (e.g., TSCA, CERCLA, Michigan Act 245, Michigan Act 641).

C. FACILITY DESCRIPTION

Gold Shield Solvents, a subsidiary of the Detrex Corporation, is located at 12886 Eaton Avenue in Detroit, Michigan. The facility specializes in the recovery of spent solvents from sludges generated during degreasing operations, and the sale of halogenated solvents and cleaning equipment to small volume i.e., "less-than-a-truckload", customers. The Gold Shield Solvents facility covers 0.9 acres, has approximately 7500 square feet under roof and employs seven full time individuals (see the facility map, Attachment I).

All hazardous wastes received by and generated at the facility consist of F001 and F002. Attachment II, provided in the facility's Act 64 application, lists all the hazardous constituents received, generated and stored on site. The hazardous wastes generated at the facility consist of residual waste bottoms associated with the recycling process. Hazardous wastes received by the facility are generally contained in 55 gallon drums. Upon receipt, all drums are labeled and placed in a designated area of the hazardous waste container storage area. Subsequently these wastes are transferred to the solvent

recovery process area, where the recycling process is conducted. Periodically, bulk shipments of hazardous wastes are received by the facility via tanker truck. These bulk shipment wastes are transferred directly to the solvent recovery process system. After processing, the recycled product is stored in the tank farm located on the west side of the facility's main building.

The hazardous waste container storage area has a maximum potential inventory of 231 55 gallon drums (12,700 gallons). Drums are stored in the vertical position and are situated in rows with adequate aisle space for inspections. Except for sampling, once placed in storage all drums remain sealed.

In addition to the hazardous waste container storage area, the facility identified twelve SWMUs in the Act 64 application. These SWMUs are associated with the solvent recycling process and are/were housed within the facility's main structure (see the facility map, Attachment I).

D. HYDROGEOLOGICAL CONDITIONS

The Gold Shield Solvents facility is located on a flat lacustrian plain which was formed during the Wisconsinian glaciation of the late Pleistocene. These lacustrian deposits consist primarily of clays and silt. Underlying the glacial deposits at the site is the Coldwater Shale, a Mississippian deposit. There are no test borings or ground water monitoring wells on-site, and no known injection or withdrawal wells within 1 mile. The closest major body of surface water is the Rouge River, approximately 5 miles east of the site. With an average vertical elevation of 655 feet above the National Geodetic Vertical Datum (NGVD), the site lies outside both the 100 year and 500 year floodplain.

In the section of Detroit in which Gold Shield Solvents is located, the topography slopes gradually south. Except for a section of the facility's east wall, surface water runoff is away from the building perimeter. In the area adjacent to the east wall, a sump 12 inches in diameter and 6 inches deep had been placed to collect runoff. This sump is being discharged to the gravel yard north-east of the facility. The company sampled the fluid in the sump on February 13, 1989. The analytical results are included in Attachment V. Detrex does not possess analytical data for the soils in the gravel yard.

E. RECEPTOR INFORMATION

Gold Shield Solvents is located in an industrial area of Detroit, which is adjacent to residential housing. The nearest residence is approximately 300 feet from the site. The Betzel Playground is located approximately 700 feet from the site.

F. **FILE REVIEW/COMPLIANCE HISTORY**

1-26-82 RCRA Compliance Inspection
- -absence of danger signs
- -absence of facility inspection log
- -personnel training records were not complete
- -absence of communication device at tank storage area
- -absence of documentation regarding community notification
- -absence of facility evacuation plan
- -contingency plan not available to local emergency organizations
- -absence of hauler certification on one waste manifest

1-04-83 RCRA Compliance Inspection, no violations

12-12-83 RCRA Compliance Inspection
- -waste analysis plan deficient
- -inspection log deficient
- -personnel training records absent
- -maintenance regarding release minimization deficient
- -absence of documentation regarding local authorities and response teams
- -contingency plan deficient
- -closure plan deficient
- -unsealed stored waste containers
- -labeling deficiencies
- -storage capacity exceeded

1-13-84 RCRA "Follow-Up" Compliance Inspection
- -deficiencies noted during 12-12-83 inspection corrected

10-06-85 RCRA Compliance Inspection
- -absence of proper labeling at entrances
- -absence of annual training reviews

6-03-86 RCRA Compliance Inspection, no violations

12-03-86 RCRA Compliance Inspection, no violations

3-01-88 RCRA Compliance Inspection, no violations

G. **SOLID WASTE MANAGEMENT UNITS (SWMUs)**

The recycling process for Gold Shield Solvents is housed within the facility's main structure. The interior of the building is curbed, and provided with secondary containment. All process SWMUs described below are above ground units. The SWMU units numbers were assigned by the company in the facility's Act 64 application. A process flow diagram is provided in Attachment III. In Attachment IV are the photographs of the SWMUs taken during the VSI.

SWMUs ASSOCIATED WITH THE RECYCLING PROCESS

Sump: A sump to collect run-off located along the east wall of the building 6 inches deep and 12 inches in diameter. The sump is discharged to the gravel yard north-east of the facility.

Unit 22: F001 Feed Tank; installed 1987

4,000 gallon steel process tank used for temporary storage of in-process F001 waste liquids prior to processing.

Unit 12 F002 Feed Tank; installed 1986

2,300 gallon steel process tank used for temporary storage of in-process F002 waste liquids prior to processing.

Unit 13 Distillation Unit, S-350; installed 1965

Used for the recovery of F001 liquids through distillation. Unit can process approximately 2,000 gallons of waste per day.

Unit 14 Distillation Unit; S-600; installed 1970

Used for the recovery of F001 liquids through distillation. Unit can process approximately 2,000 gallons per day.

Unit 15 DCl Distillation Unit (Model Dyna-l-100); installed 1983

Used to recover F002 liquids through distillation. Unit can process approximately 800 gallons per day.

Unit 24 DCl Distillation Unit (Model Dyna-l-500); installed 1986

Used to recover F002 liquids through distillation. Unit can process approximately 500 gallons per hour.

Unit 17 Distillation Bottoms Tank; installed 1980

Used for the temporary storage F001/F002 distillation process waste (bottoms) from the four distillation units.

Unit 23 Decant Tank; installed 1980

1,500 gallon process waste water tank, use for the collection of process waste water.

Unit 19 Wiped Film Evaporator; installed 1985, removed 1986

Rodney Hunt Machine Co., Model - 577575, which was used for the recovery of F001 materials. This unit could process approximately 2,400 gallons per day.

Unit 10 Solvent Receiver Tank; installed 1985

750 gallon solvent receiver tank. All four process stills discharge to this tank.

Unit 16 Drying Columns; original unit installed in 1965, replaced in 1987.

Solvent from unit 10 is sent through this unit to remove residual water.

Unit 20 Stabilizer Mix Tank; installed 1985

2500 gallon tank with agitator and addition pump for the addition of chemical stabilizers to solvent as final step in reclamation process.

H. HAZARDOUS WASTE CONTAINER STORAGE AREA

The hazardous waste drum storage area is completely enclosed within the building. The building floor, including the hazardous waste drum storage area consists of concrete with peripheral concrete curbing for secondary containment. All entrances are diked with concrete ramps. All concrete curbing has been coated with Surlwall Surface Bonding Cement. There are no floor drains or other openings in the secondary containment area. The storage area has a maximum potential inventory of 231 55 gallon drums (12,700 gallons). At capacity, the drums would be stacked vertically three high, with adequate aisle space to allow for inspection. The secondary containment capacity has been calculated to be 24,562 gallons.

All drums accepted by the facility are inspected for leaks, corrosion rust, physical damage, proper labeling and manifesting. Except for sampling, all drums remain sealed while in storage. The chlorinated solvent wastes placed in the storage area are compatible with standard DOT steel drums. However, to prevent corrosion, trichloro-trifluoroethene (Freon) wastes handled by the facility are placed in drums lined with an epoxyphenolic material.

I. VISUAL SITE INSPECTION (VSI)

A. Purpose

The purpose of the VSI is to identify and visually inspect the SWMUs at the facility for evidence of release. This information will be used as a basis for later steps in the corrective action process.

The major objectives of the VSI include:

- Ensuring that all SWMUs and areas of concern have been identified;

- Visually inspecting the SWMUs and areas of concern at the facility for evidences of release of hazardous wastes or constituents;

- Gathering information needed to fill data gaps identified in the PR;

- Focusing recommendations regarding the necessity for a subsequent sampling visit, or an RCRA Facility Investigation (RFI).

B. Scope

The VSI includes the entire RCRA facility and can extend beyond the facility boundary, if necessary. The VSI is generally limited to the collection of visual evidence (e.g., photographic documentation) of potential releases from SWMUs and areas of concern.

C. VSI Inspection Summary

A VSI was performed at the Detrex Gold Shield Solvents facility in Detroit, Michigan on November 15, 1988. The following individuals were present during the VSI:

Charles Guy, Environmental Manager, Detrex
Ronald Swan, Operations Manager, Detrex
Michael Tepatti, Project Development Manager, Midwest District Manager, Detrex
Wayde Hartwick, U.S. EPA, Region V, Geologist
David Petrovski, U.S. EPA, Region V, Geologist

The need to obtain a HSWA Federal Permit as well as a Michigan Act 64 RCRA License was explained to facility representatives, and the purpose and scope of the VSI and the corrective action provisions were summarized. According to Detrex representatives, no known releases have occurred at the site.

All of the SWMUs at the Detrex Gold Shield Solvents are located within the facility's main buildings. All sections of the building in which hazardous wastes are stored, handled, or treated are curbed and have secondary containment. There are no floor drains or other openings in the secondary containment areas. During the VSI, all SWMUs at the facility were observed and photographed. No evidence of release of hazardous waste or constituents from the SWMUs was observed at the Detrex Gold Shield Solvents facility.

D. Conclusions and Recommendations

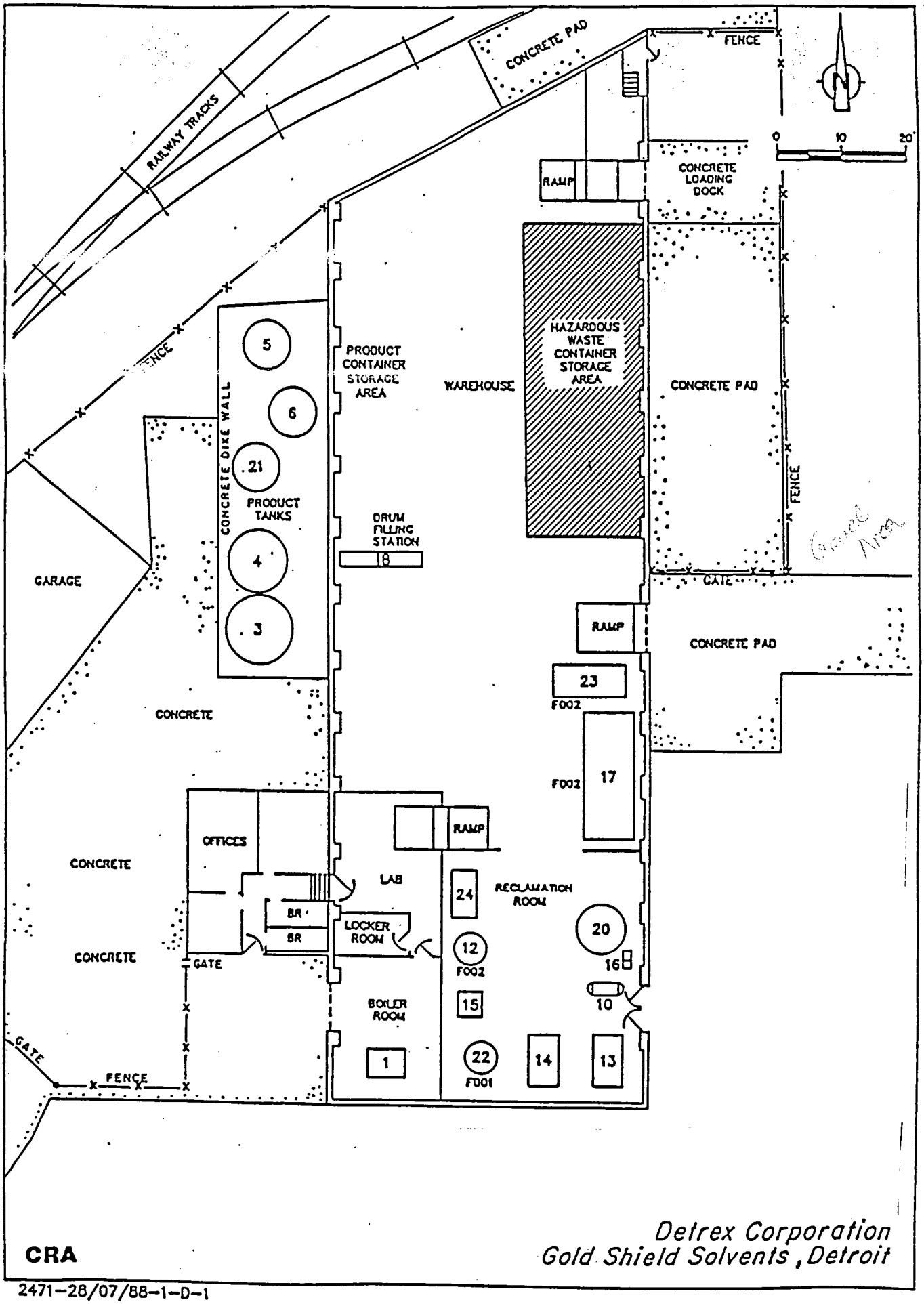
A PR and a VSI have been performed at the Detrex Gold Shield Solvents facility in Detroit, Michigan. Housed within the

facility's main building are thirteen SWMUs. Based upon the PR and the VSI, the following recommendations and conclusions can be made:

1. The analytical data for fluid in the sump collected on February 13, 1989, indicates the presence of "low level" organic and inorganic contaminats (Attachment V). As such, the soils in the vicinity of the "gravel yard" should be analyzed for the hazardous constituents in Appendix IX.

2. At present there is no evidence of release/s from the other SWMUs at the site, and sampling at these locations is unnecessary.

ATTACHMENT 1



CRA

Detrex Corporation
Gold Shield Solvents, Detroit

2471-28/07/88-1-D-1

Date: 11/08/88
Revision: 88-0

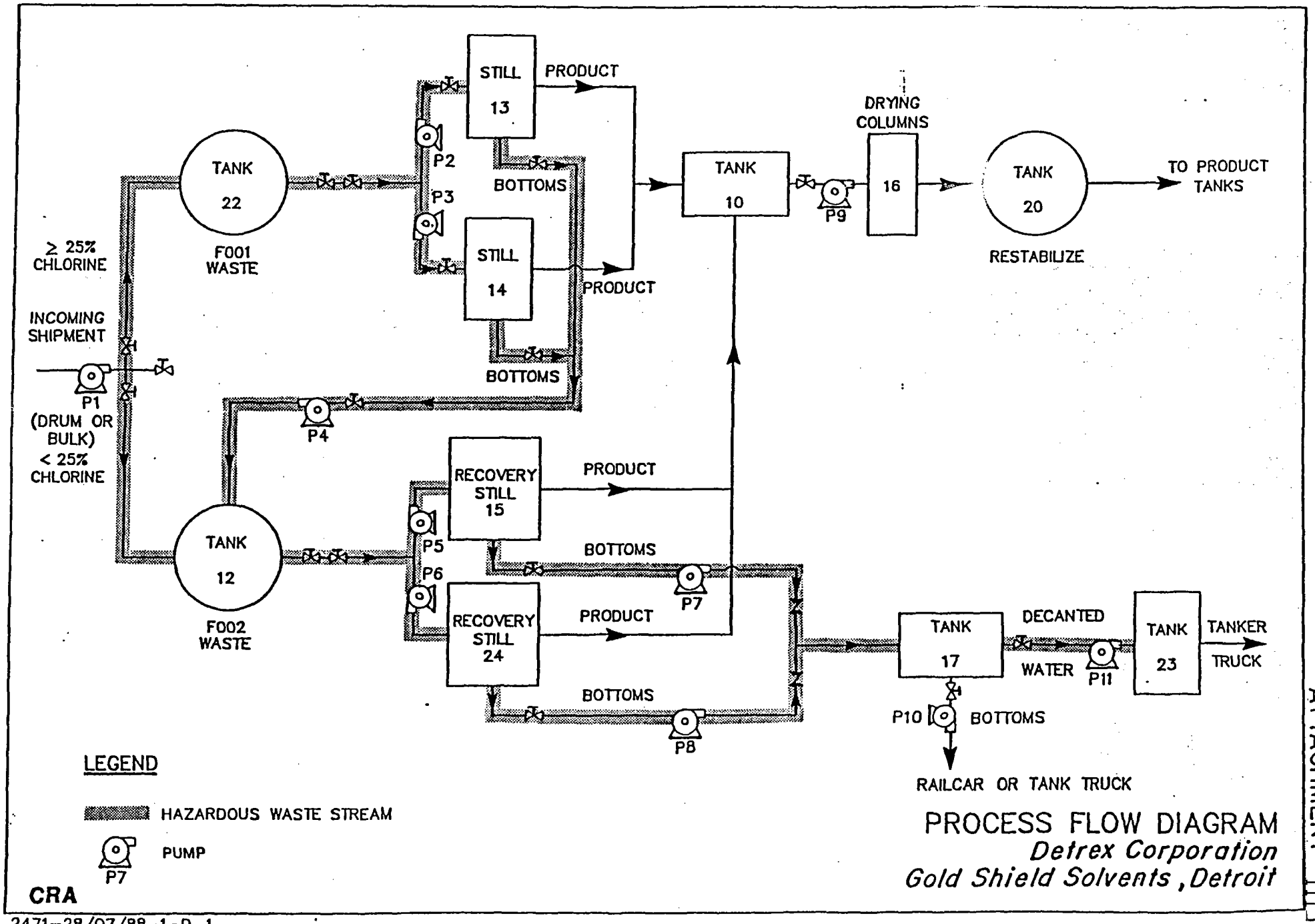
ATTACHMENT II

LIST OF HAZARDOUS WASTES

Hazardous Waste	EPA Hazardous Waste Number	Hazardous Constituent/Characteristic	EPA Process Code	Physical State
1,1,1 Trichloroethane	F001	Toxic	S01, T04	Liquid
Trichloroethylene	F001	Toxic	S01, T04	Liquid
Methylene Chloride	F001	Toxic	S01, T04	Liquid
Perchloroethylene	F001	Toxic	S01, T04	Liquid
Trichlorotrifluoroethane (Freon)	F001	Toxic	S01, T04	Liquid
1,1,1 Trichloroethane	F002	Toxic	S01, T04	Sludge *
Trichloroethylene	F002	Toxic	S01, T04	Sludge *
Methylene Chloride	F002	Toxic	S01, T04	Sludge *
Perchloroethylene	F002	Toxic	S01, T04	Sludge *
Trichlorotrifluoroethane (Freon)	F002	Toxic	S01, T04	Sludge *

Notes:

* - Represents a waste stream that has been partially distilled at the customers degreasing operation facility.

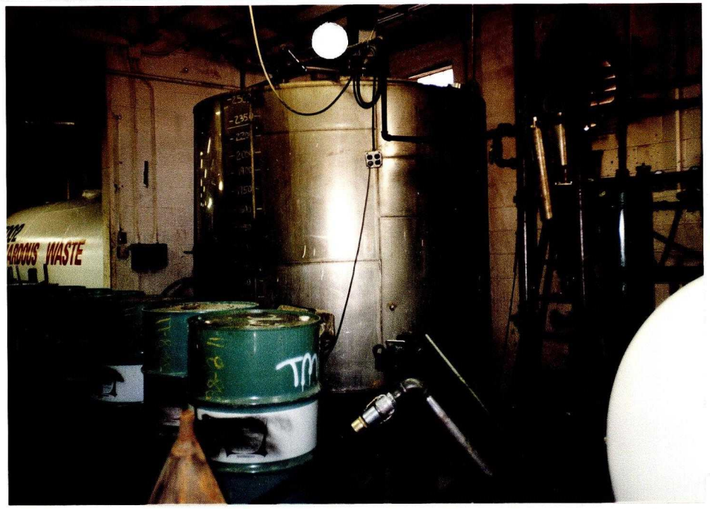


2471-28/07/88-1-D-1

ATTACHMENT IV

TANK 20 DRY SOLVENT PRODUCT PRIOR TO STABILIZATION 2500 GALLONS

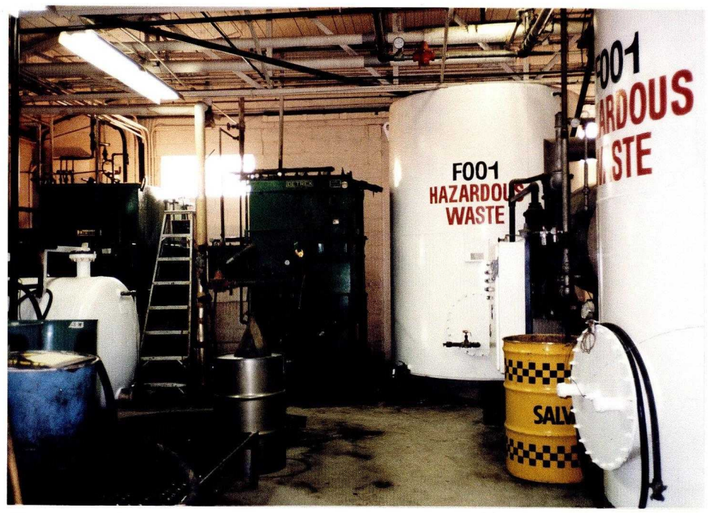
PHOTO #: 4 of 10 GPO 838-339



SWMUs 13 + 14

DISTILLATION UNIT MODELS S-350 AND S-600 (GREEN UNITS)

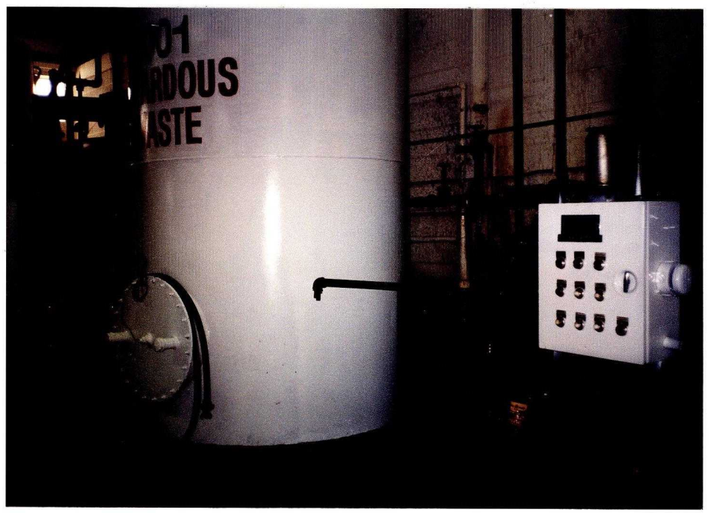
PHOTO #: 5 of 10 GPO 838-339



SWMUs 15 + 24

DISTILLATION UNIT MODELS DYNA-1-100 AND DYNA-1-500 AT RIGHT OF PHOTO

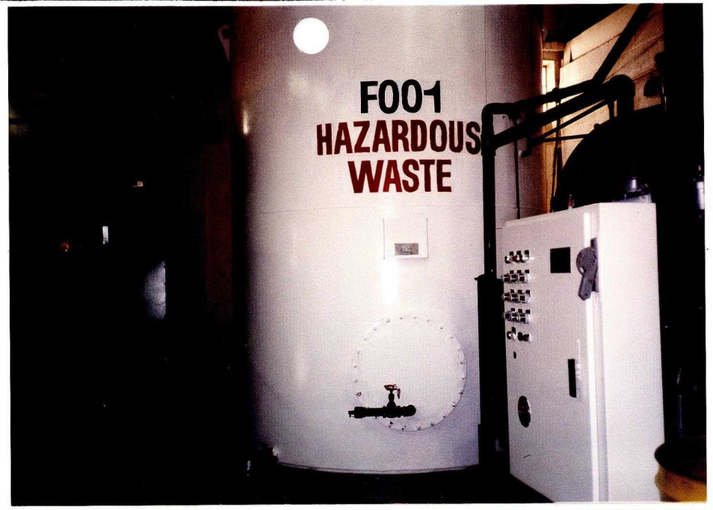
PHOTO #: 6 of 10 GPO 838-339



SWMU 22

4,000 GALLON F001 FEED TANK

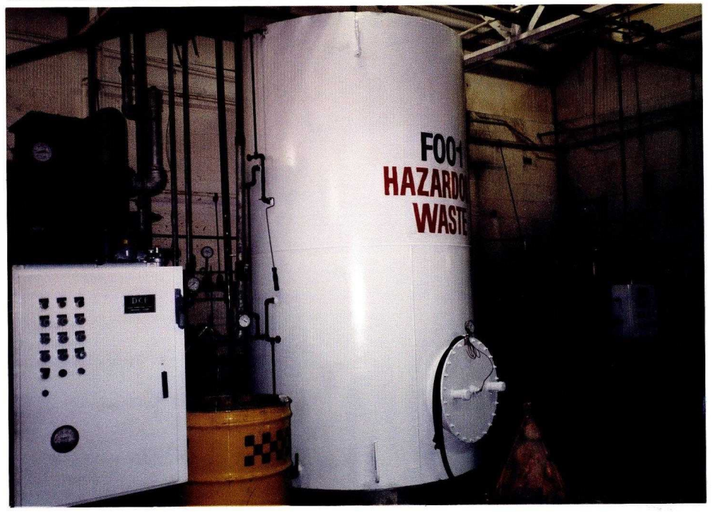
PHOTO #: 1 of 10 GPO 838-339



SWMU 12

2,300 GALLON PROCESS FEED TANK

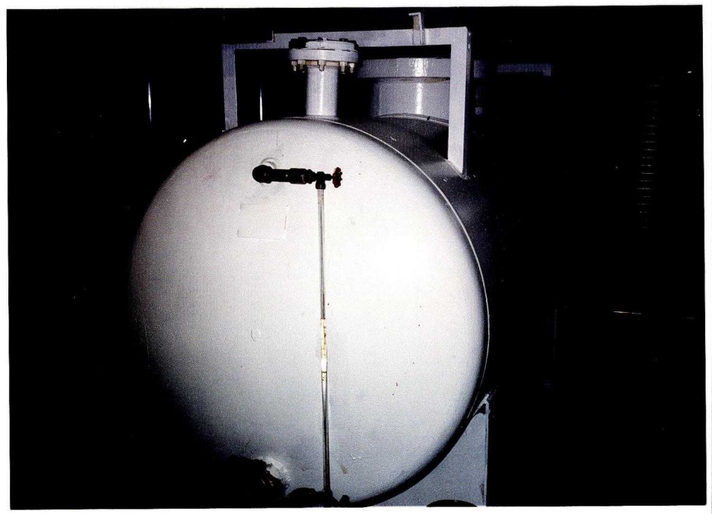
PHOTO #: 2 of 10 GPO 838-339



UNIT 10

750 GALLON "WET" PRODUCT TANK

PHOTO #: 3 of 10 GPO 838-339



PRODUCT STORAGE
TANK FARM

PHOTO #: 10 of 10

PHOTO #: _____ of _____

PHOTO #: _____ of _____

SWMU 17

5,000 GALLON F001/F002
STILL BOTTOMS STORAGE
TANK

PHOTO #: 7 of 10

SWMU 23

1,500 GALLON
ACCUMULATION TANK
FOR THE COLLECTION
OF PROCESS WASTE
WATER

PHOTO #: 8 of 10

REGULATED
HAZARDOUS WASTE
CONTAINER (DRUM)
STORAGE AREA

PHOTO #: 9 of 10